



Thunderbolt Display (27-inch)

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About This Guide

Thunderbolt Display (27-inch)

Updates

Updated 24 July 2012

Take Apart

- **Basics > Safety:** Added Important note instructing technician to wait one (1) hour after unplugging the computer from the electrical outlet before removing the power supply or working near the power supply leads.
- **General Info > Safety and Power Supply:** Added Important note instructing technician to wait one (1) hour after unplugging the computer from the electrical outlet before removing the power supply or working near the power supply leads. The power supply contains a high voltage capacitor that may remain charged for up to an hour after unplugging the computer.

Updated 2 March 2012

Take Apart

- **Logic Board:** Added text and table regarding new service part number 661-6489, and how to determine correct part number for unit being repaired.
- **Rear Housing:** Removed mention of power supply sensor cable, which is no longer included with a new rear housing.

Views

- **Exploded View:** Added new logic board part number 661-6489.

Updated 23 November 2011

Basics

- **Thunderbolt:** Added link to Apple Support article [HT4951: Apple Thunderbolt Display \(27-inch\): About Boot Camp and Windows 7](#).

Troubleshooting

- **General Troubleshooting > Update Software and Firmware:** Added link to Apple Support article [HT4644: Getting the best performance from Thunderbolt](#).
- **Symptom Charts > Mechanical Issues > Noise/ Hum/ Vibration:** Added Quick Check #3, "With display connected, check for and apply all available software and firmware updates to both the computer and the display."

Take Apart

- **LCD Panel:** Step 3: Modified text and images to more accurately represent the actual removal order of the 4 cables.
- **Camera:** Updated instruction to download EEPROM Reset Tool from GSX by navigating to Resources, then selecting both "Displays" and "Service Disk Image".
- **Logic Board:** Added "Important Replacement Note: After installing a new logic board, check

for and install any available Thunderbolt Display firmware updates prior to returning display to the user.”

- **Power Supply Sensor Cable:** Added text “This cable is not present in all units, and is not required for functionality.”

Views

- **Exploded View:** Removed Power Supply Sensor Cable.

Introduced 14 September 2011

Feedback

We want your feedback to help improve this and future Technician Guides!

Please email any comments to: smfeedback6@apple.com

Basics

Thunderbolt Display (27-inch)



Overview



Identifying Features

The Thunderbolt Display (27-inch) is a TFT active-matrix liquid crystal display with LED backlight that includes a built-in FaceTime HD camera with microphone and a 2.1 speaker system (49 watts). It supports resolutions up to 2560 by 1440 pixels. The all-in-one cable creates a docking station for portable computers, providing a universal MagSafe (up to 85W) and Thunderbolt, FireWire 800, USB 2.0 and Gigabit Ethernet ports. See support.apple.com/specs for details.

The Thunderbolt Display (27-inch) can be most easily distinguished from the previous model LED Cinema Display (27-inch) by the additional rear ports: Thunderbolt, FireWire 800 and Gigabit Ethernet. Also, the all-in-one cable has two connectors (Thunderbolt and MagSafe) as opposed to the previous model's three connectors (Mini DisplayPort, USB and MagSafe).

The display has no buttons. Power is controlled by the state of the connected computer (see table). Brightness and speaker volume are controlled via System Preferences in OS X. MagSafe provides power in all modes, including OFF, as long as the display is connected to AC power.

Host Computer State	Thunderbolt Display State
OFF or display not connected	OFF
Display Sleep or no valid video signal	Sleep
ON with valid video signal	ON

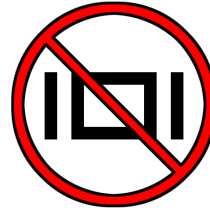


System Requirements

The Thunderbolt Display (27-inch) works with Thunderbolt-capable Mac computers running:

- Mac OS X Snow Leopard 10.6.8 or later, with Thunderbolt Software Update 1.0
- OS X Lion 10.7.1 or later, with Thunderbolt Software Update 1.0

Important: Although Thunderbolt and Mini DisplayPort connectors are the same shape and size, the Thunderbolt Display (27-inch) will not work when connected to a computer via Mini DisplayPort (the symbol on the right below). The host computer must have a Thunderbolt port (the symbol on the left below).



Connecting Multiple Displays

<p>Thunderbolt-capable computers with discrete GPUs (video cards) can support <u>one or two</u> of the Thunderbolt Display (27-inch):</p> <ul style="list-style-type: none">• MacBook Pro (15-inch, Early 2011)• MacBook Pro (17-inch, Early 2011)• iMac (Mid 2011)¹• Mac mini (Mid 2011, Best)	
<p>Thunderbolt-capable computers with integrated GPUs can support <u>one</u> Thunderbolt Display (27-inch):</p> <ul style="list-style-type: none">• MacBook Pro (13-inch, Early 2011)²• MacBook Air (Mid 2011)• Mac mini (Mid 2011, Good & Server)	

¹The iMac (27-inch, Mid 2011) has two Thunderbolt ports, but still only supports a total of two Thunderbolt Display (27-inch). They can be daisy-chained on the same port or each connected to a different port.

²The MacBook Pro (13-inch, Early 2011) can have two connected Thunderbolt Display (27-inch), but when the second display is connected, the built-in display will go dark.



Thunderbolt

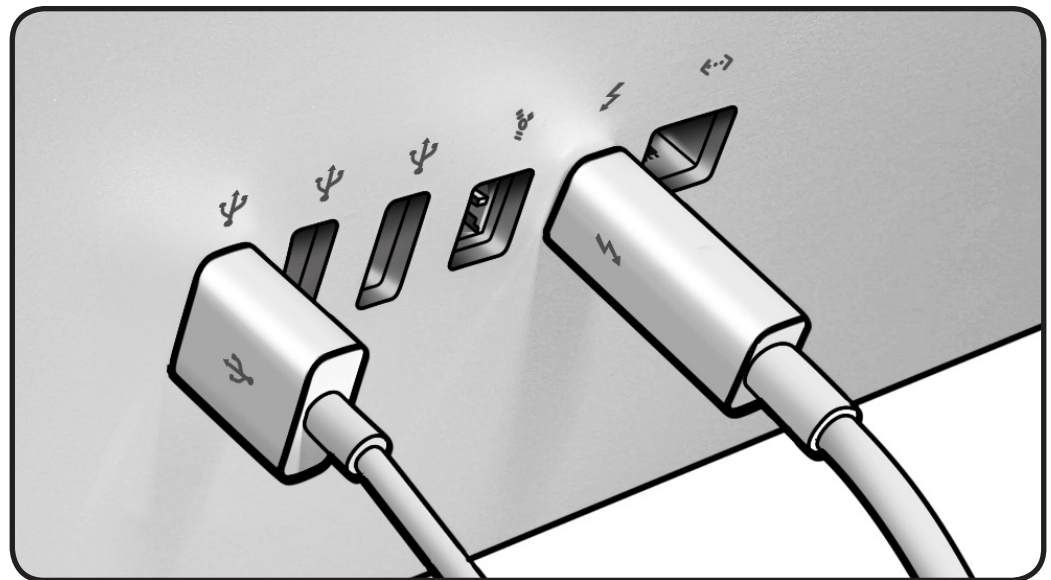
Thunderbolt is a revolutionary I/O technology that supports high-resolution displays and high-performance data devices through a single, compact port. It sets new standards for speed, flexibility, and simplicity. Read more at www.apple.com/thunderbolt



Important: The rear Thunderbolt port on the Thunderbolt Display (27-inch) will only accept Thunderbolt devices, not Mini DisplayPort devices. This is different behavior than Thunderbolt-capable computers, which can accept either Thunderbolt or Mini DisplayPort devices.

Caution: The Thunderbolt port is keyed for cable insertion in only one direction. Be sure to insert cables with the correct orientation. Do not use excessive force if the cable does not fit.

Reassembly Note: The Thunderbolt port has a precise fit. To properly align logic board with rear housing, you **MUST** plug in cables to the Thunderbolt port and also to the furthest left USB port while tightening screws.



For more information, see the following Apple Support articles:

- [HT4644: Getting the best performance from Thunderbolt](#)
- [HT4614: About Thunderbolt to Thunderbolt cable \(2 m\)](#)
- [HT4617: Using Thunderbolt with Boot Camp and Windows 7](#)
- [HT4951: Apple Thunderbolt Display \(27-inch\): About Boot Camp and Windows 7](#)



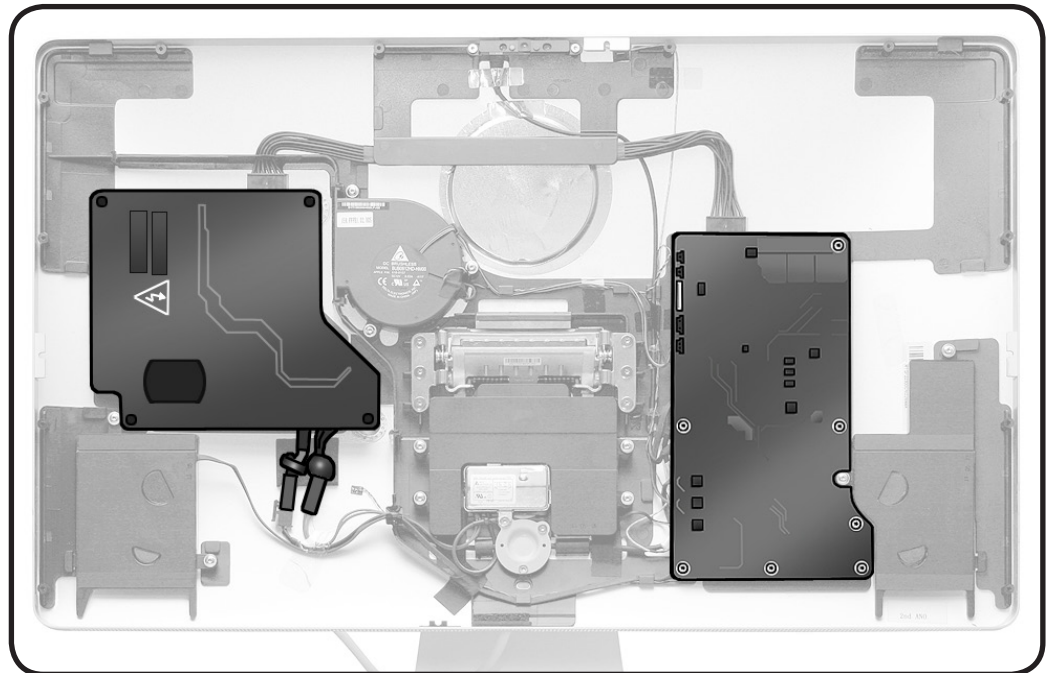
Safety Precautions



Warning: HIGH VOLTAGE: The AC/DC power supply board and logic board remain powered up whenever the system is plugged in. Use extreme caution when troubleshooting the display with glass panel and LCD panel removed.

- Don't work alone. In the event of electrical shock it is important to have another individual present who can provide assistance.
- Keep one hand in your pocket when working on any unit that is plugged in. This will help ensure that your body does not provide a path to ground in the event that you accidentally make contact with line voltage.
- Don't wear jewelry, watches, necklaces, or other metallic articles that could present a risk if they accidentally make contact with power supply circuitry.

Important: Wait one (1) hour after unplugging the computer from the electrical outlet before removing the power supply or working near the power supply leads. The power supply contains a high voltage capacitor that may remain charged for up to an hour after unplugging the computer.

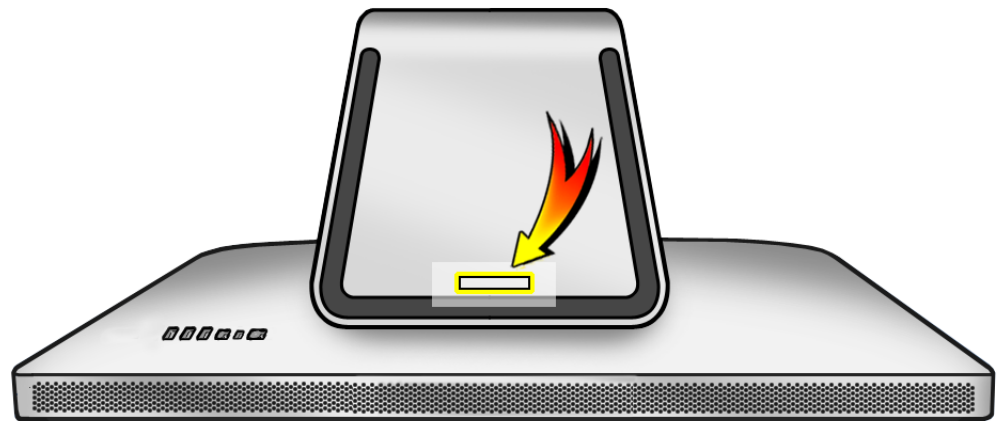




Serial Number Location

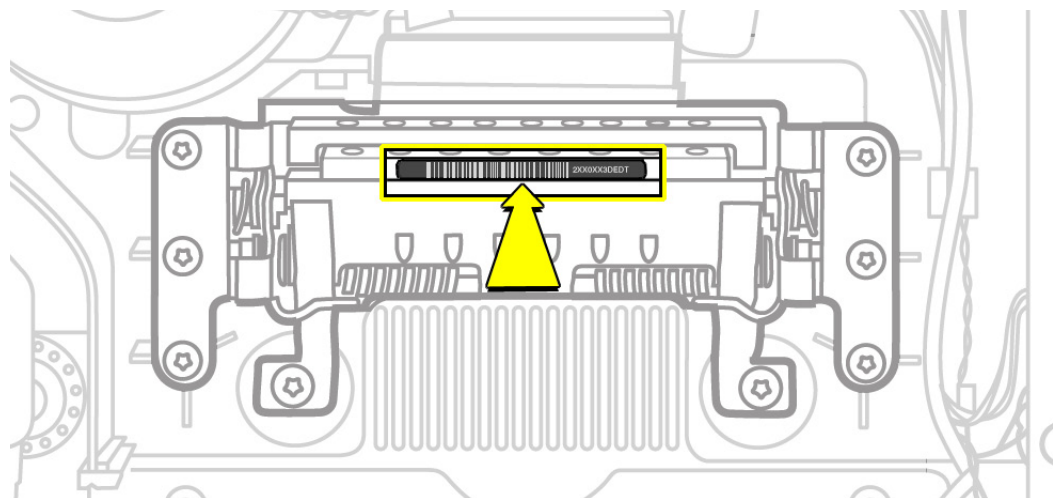
Serial Number on Stand

The Thunderbolt Display (27-inch) serial number is located on the base of the stand. When replacing a stand, transfer the serial number to the new stand.



Serial Number on Mechanism

The Thunderbolt Display (27-inch) serial number is also located on the hinge mechanism inside, for users who remove the stand to use a VESA mount. When replacing a mechanism, transfer the serial number label to the new mechanism.



Troubleshooting

Thunderbolt Display (27-inch)



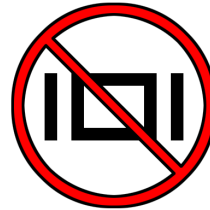
General Troubleshooting

System Requirements

The Thunderbolt Display (27-inch) works with Thunderbolt-capable Mac computers running:

- Mac OS X Snow Leopard 10.6.8 or later, with Thunderbolt Software Update 1.0
- OS X Lion 10.7.1 or later, with Thunderbolt Software Update 1.0

Important: Although Thunderbolt and Mini DisplayPort connectors are the same shape and size, the Thunderbolt Display (27-inch) will not work when connected to a computer via Mini DisplayPort (the symbol on the right below). The host computer must have a Thunderbolt port (the symbol on the left below).



Update Software and Firmware

Important: Before troubleshooting, connect the Thunderbolt Display (27-inch) to a known-good Thunderbolt-capable computer and attempt to **install all available updates to both the computer and the display**. Updates may correct or improve the device behavior by applying firmware updates to the Thunderbolt cable, logic board, LCD panel or camera modules. Updates may be available via the Automatic Software Update or via the Apple Support page. For more information, refer to Apple Support article [HT4644: Getting the best performance from Thunderbolt](#).

Troubleshooting Theory

For general information on troubleshooting theory, go to GSX and find the Service Training course menu link. From there you can access the Troubleshooting Theory self-paced course. Also, refer to the following Apple Support articles:

- [TS1388: Isolating issues in Mac OS X](#)
- [HT1199: Mac OS X: How to troubleshoot a software issue](#)



Functional Overview

A guide to connector locations, and the possible symptoms when a cable is disconnected, mis-connected or shorted.

Fan Sensor

- Display getting hot
- Fan running at full speed
- Display shuts down if too hot

Power Supply Sensor

- Display getting hot
- Fan running at full speed
- Display shuts down if too hot

DisplayPort

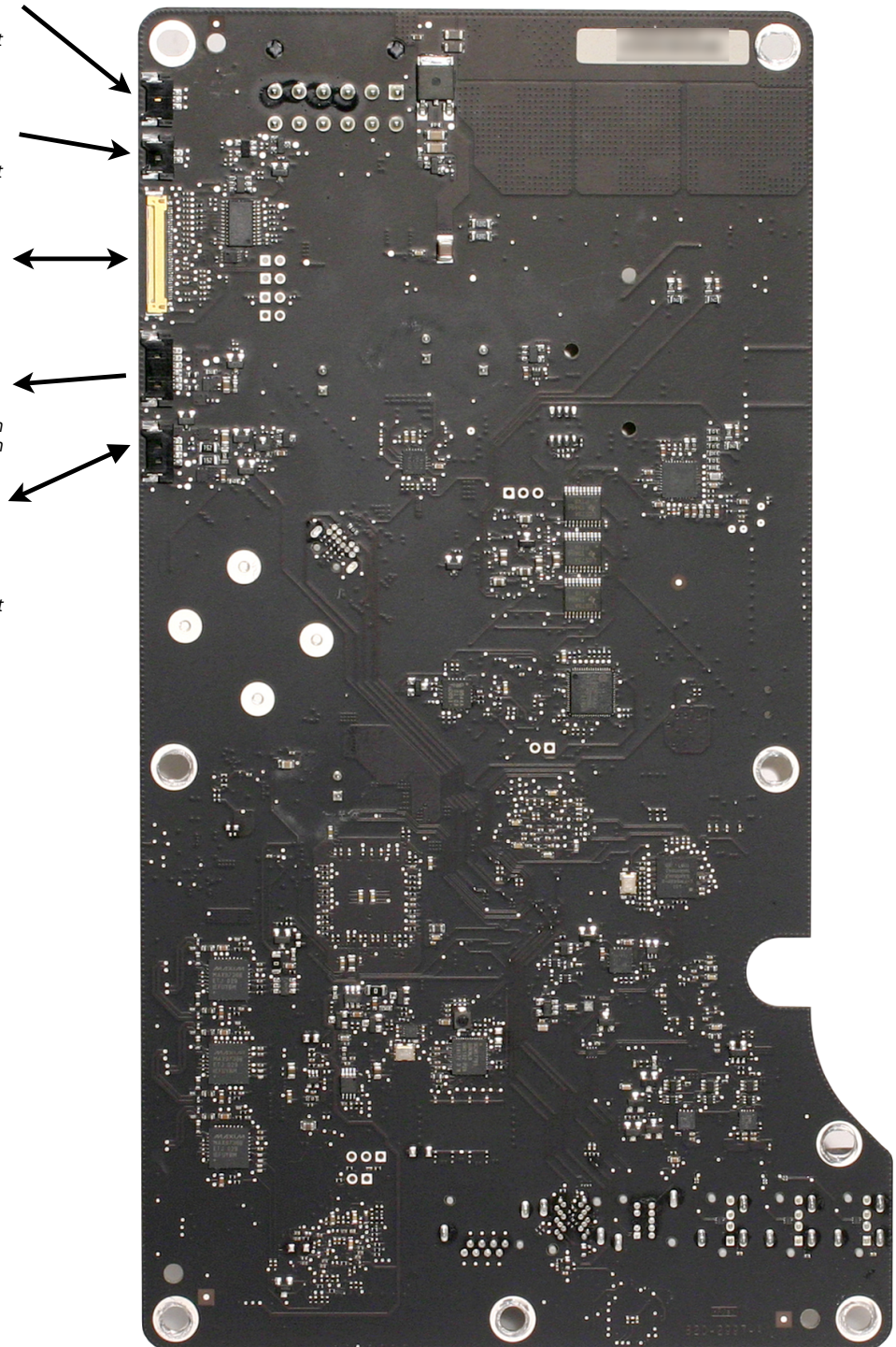
- LCD panel not seen in System Information (System Profiler in Snow Leopard)
- No video
- Distorted video

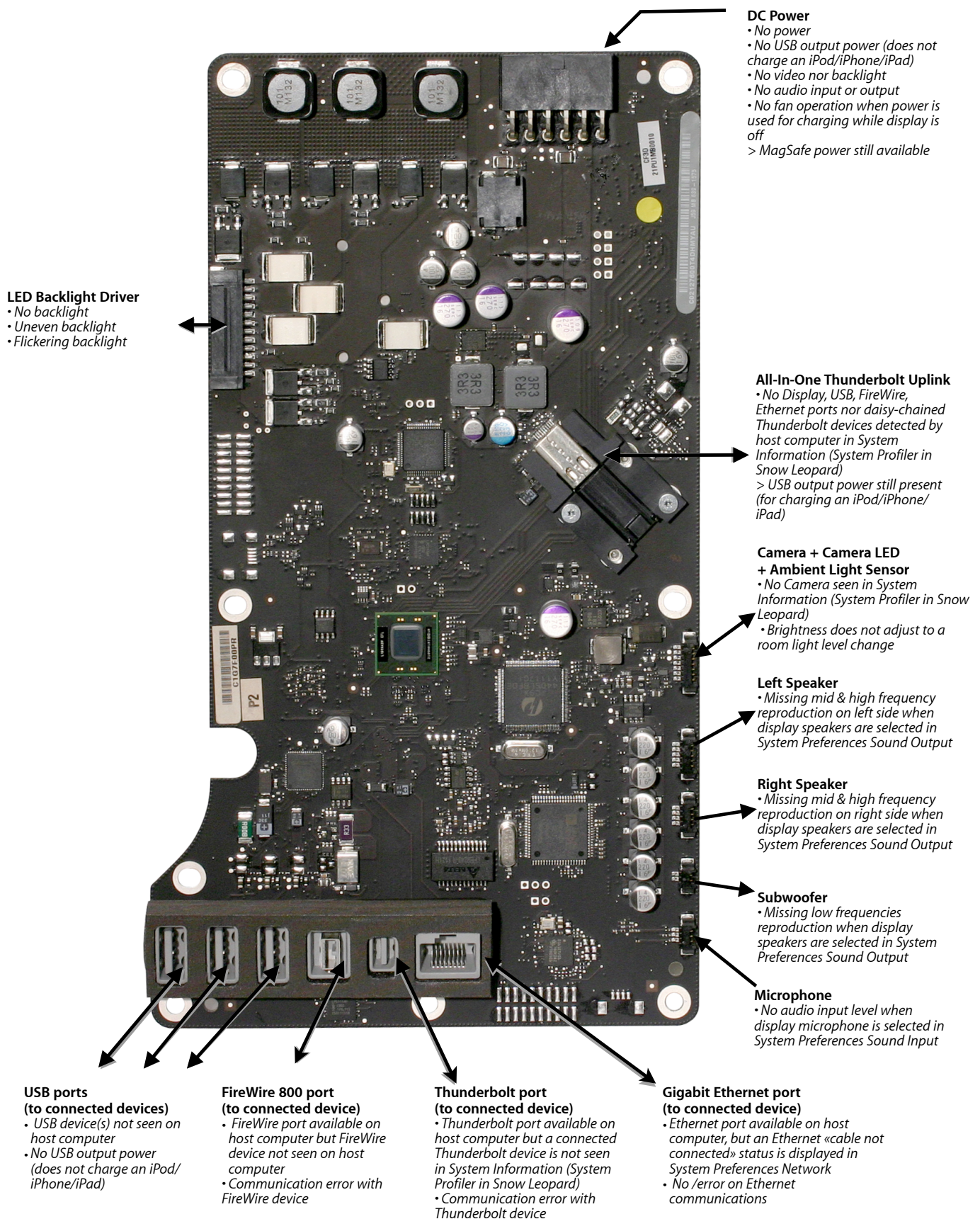
DisplayPort Power

- LCD panel not seen in System Information (System Profiler in Snow Leopard)

Fan Power

- Fan not running
- Display getting hot
- Fan running at full speed
- Display shuts down if too hot

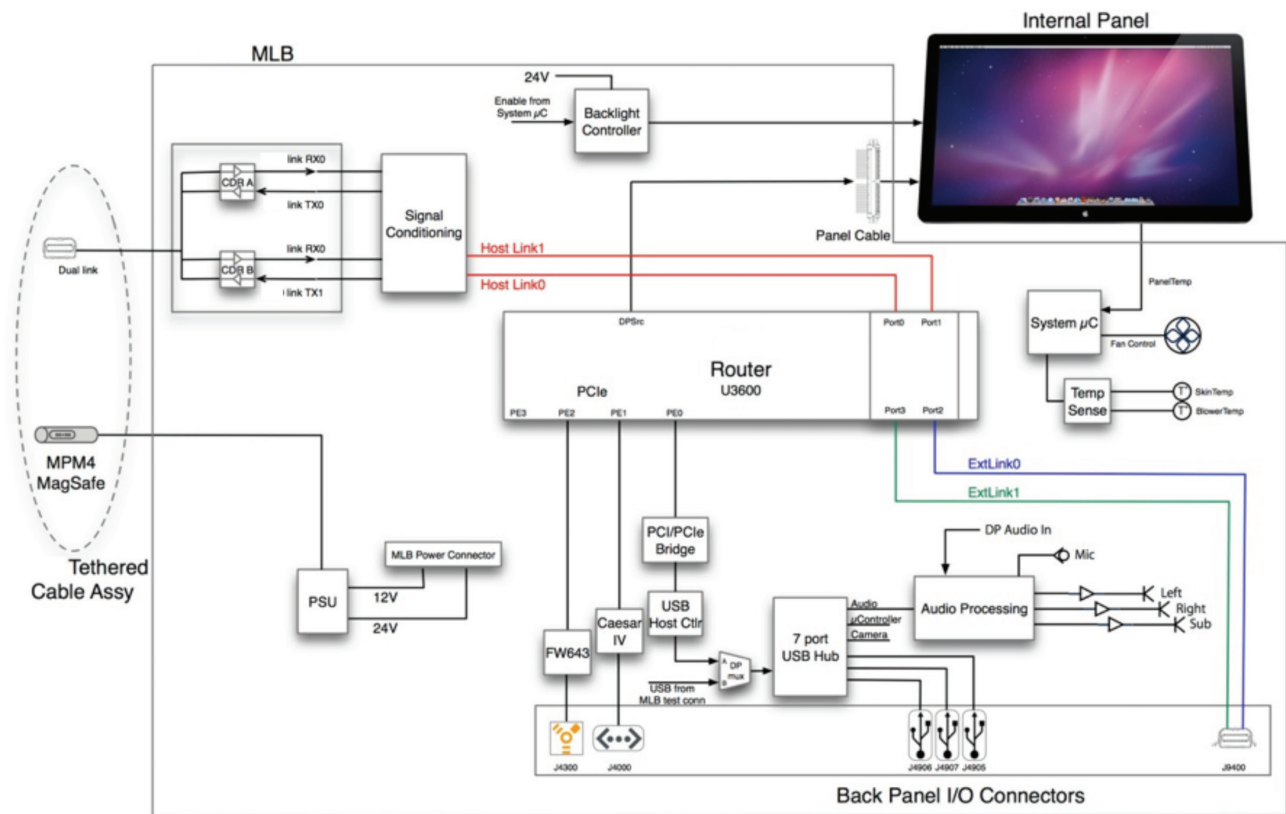






Block Diagram

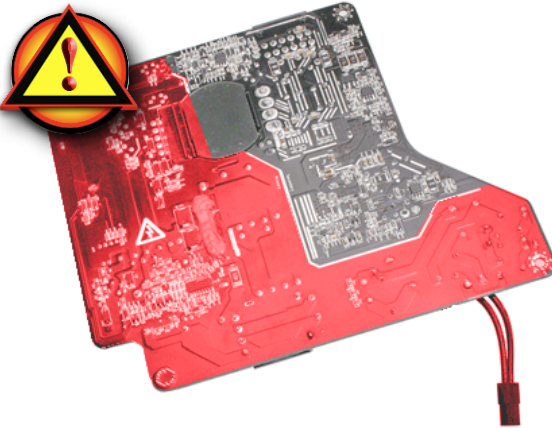
Refer to this diagram to see how modules are interrelated





Test Points Diagram

Also see Apple Support article [HT3250: Diagnostics: Using a digital multimeter](https://support.apple.com/HT3250).



Warning! HIGH VOLTAGE:

Use extreme caution when working around the power supply.

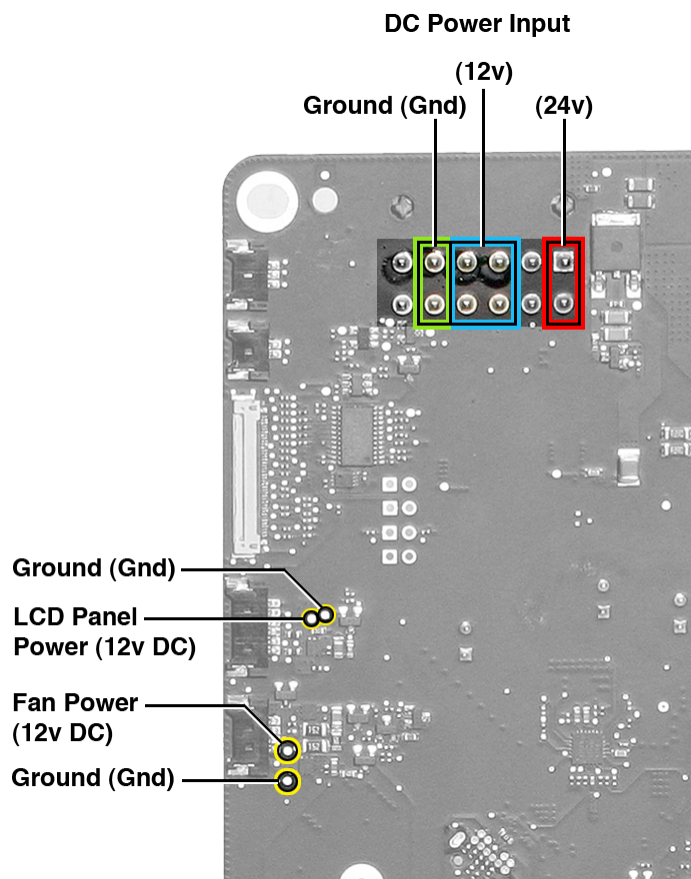
- Never touch the leads on bottom and left side of the power supply around the warning sign.
- Do NOT lean over or accidentally touch power supply area during living testing.
- Keep your fingers behind the finger guards of the test probes when making measurements!

Test Points for DC Power Presence

Following are test points you can use to verify proper power flow in the Thunderbolt Display (27-inch). All voltages assume that the display is only plugged into a power outlet, and NOT into the host computer.

How to proceed:

- Turn the dial of your voltmeter/multimeter to measure DC (direct current). If your voltmeter requires that you set a voltage range, choose a DC range that includes the voltage that you are measuring.
- Connect the black probe to ground by gently inserting into any of the logic board screw posts.
- Touch the red probe to the appropriate test point.
- Verify voltage on multimeter.
- For USB power presence, connect a known-good iPod, iPhone or iPad and check for a lightning bolt icon visible on the device's screen.





Symptom Charts

Follow steps in the order indicated below. If an action resolves the issue, retest to verify.

Startup and Power Issues

No Power

Unlikely causes: microphone

Quick Check

Symptoms	Quick Check
No Power <ul style="list-style-type: none">• No power• No image• No fan spin• No active MagSafe LED when MagSafe is connected to a portable Mac computer.• No iPod/iPhone/iPad is charged or powered when connected to USB ports on display.	<ol style="list-style-type: none">1. Verify that display is connected to a known-good electrical source with a known-good power cord.2. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)3. Verify that Thunderbolt and MagSafe connectors are fully seated.4. Check brightness setting.5. To confirm that external display is recognized, open System Preferences > Displays (or press Option-F2), and verify that the middle Arrangement tab is present.6. With display connected, check for and apply the latest software and firmware updates.



Deep Dive

Check	Result	Action	Code
1. Check MagSafe power. Connect display's MagSafe connector to known-good Mac portable (keep Thunderbolt cable disconnected). Check computer's Battery menu to see if display is providing power and charging battery. Does computer indicate that display is providing power?	Yes	Go to step 6.	
	No	Go to step 2.	
2. Check 5V DC presence on logic board. Connect a known-good iPod, iPhone or iPad via USB cable to one of the display's USB ports, and verify that it is powered or charged by display. Does device show any sign of power or charge from display's USB port?	Yes	Go to step 5.	
	No	Go to step 3.	
3. Check all power connections. Warning! Disconnect power cord from power source before performing this step. Verify that all cable connections to and from power supply are secure. This includes the connections to All-In-One cable, AC inlet, and logic board (via DC power cable). Are all connections secure?	Yes	Go to step 4.	
	No	Reseat power connections and retest. Go to step 17.	





4. Check AC power presence on power supply. Connect display's power cord to a known-good power source. Set digital multimeter to AC setting and range to 500V AC. Locate the two AC pins on lower right of power supply, and verify that a 100–240V current (depending on your local voltage) is present between the pins. WARNING! Make sure your fingers do not touch metal probes, pins of power supply, or any other part of the live power supply! Is 100–240V AC voltage present between test points?	Yes	Replace power supply. Go to step 17.	P01
	No	AC inlet is part of rear housing. Replace rear housing. Go to step 17.	P99
5. Check All-in-One cable connection to power supply. Power available to logic board for USB power but not to MagSafe connector. Remove glass and LCD panels, then reseal All-in-One cable to power supply. Does reseating cable connection restore power to connected computer?	Yes	Go to step 17.	
	No	Power available to logic board but not to MagSafe connection. Replace All-In-One cable. Go to step 17.	X03
6. Check 5V DC presence on logic board. Power is present on MagSafe connector. Connect a known-good iPod, iPhone or iPad via USB cable to one of the display's USB ports, and verify that it is powered or charged by display. Does device show any sign of power or charge from display's USB port?	Yes	Go to step 11.	
	No	Go to step 7.	



7. Reseat DC power cable to logic board. Power present on power supply for MagSafe but not available to logic board for USB power. Remove glass and LCD panel, then reseat DC power cable between power supply and logic board. Does reseating DC power cable restore power to connected USB device?	Yes	Power to logic board appears restored. Go to step 17.	
	No	Go to step 8.	
8. Check main 12V DC presence on logic board. Connect power cord. Set digital multimeter to DC and correct range, and verify that an 11.4–12.6V DC current is present between logic board test point (12V) and chassis ground (GND). This circuit powers everything else. Is 12V DC voltage present between test points?	Yes	12V DC power present, but logic board does not generate 5V DC for USB. Replace logic board. Go to step 17.	M01
	No	Go to step 9.	
9. Check main 12V DC presence with disconnected cables. Disconnect all connectors from logic board EXCEPT the DC power cable. Set digital multimeter to DC and correct range, then verify that an 11.4–12.6V DC current is present between logic board test point (12V DC) and chassis ground (GND). Is 12V DC voltage restored when cables are disconnected?	Yes	Go to step 10.	
	No	No 12V DC from power supply. Replace power supply. Go to step 17.	



10. Find defective cable. If 12V DC power source is restored with all devices disconnected, suspect damaged connector, cable shorting out or a defective device: LCD panel, camera, fan or speaker. Reconnect cable connectors one at a time and retest for presence of 12V DC and for 5V DC power to USB ports each time. Identify which connection disables the current. Is the 12V DC or 5V DC current missing after reconnecting any of the cables?	Yes	Go to step 13.	
	No	Reseat connections. Go to step 17.	
11. Check System Information (System Profiler). USB power is present on logic board. Connect display to known-good, supported Thunderbolt computer. Check USB device tree in System Information (System Profiler in Snow Leopard) for display's USB hub, FaceTime HD camera, FireWire 800 and Ethernet ports. Are the devices listed in System Information (System Profiler)?	Yes	Power is present on the display's logic board. Go to Blank / No Video, No Backlight .	
	No	Go to step 12.	
12. Check All-In-One cable connection to logic board. Remove glass and LCD panel, then reseat All-In-One cable uplink connector to logic board. Check System Information (System Profiler) again for USB hub, FaceTime HD camera, FireWire 800 and Ethernet ports. Are the devices listed in System Information (System Profiler) after reseating All-In-One cable?	Yes	Reassemble display. Go to step 17.	
	No	No Thunderbolt communication with display's logic board. Replace All-In-One cable. Go to step 17.	M30



13. Isolate LCD panel cable. Reconnect all cables except LCD cables (DisplayPort and DisplayPort power). If power is restored with LCD panel disconnected, then one of its cables or connectors is the culprit. Is both 5V and 12V DC current restored between test points when LCD panel cable is disconnected?	Yes	Replace DisplayPort power cable. Go to step 17.	X03
	No	Go to step 14.	
14. Isolate camera. Disconnect camera cable. If power is restored, then the camera cable or its connector is the culprit. Is both 5V and 12V DC current restored between test points after disconnecting camera cable?	Yes	Replace camera cable. Go to step 17.	X03
	No	Go to step 15.	
15. Isolate speakers. Disconnect speaker cables one at a time. If power is restored with one of the speakers disconnected, then that speaker's circuitry, cable or connector is the culprit. Is both 5V and 12V DC current restored between test points after disconnecting one of the speakers?	Yes	Replace affected speaker. Go to step 17.	X08
	No	Go to step 16.	
16. Isolate fan. Disconnect fan. If power is restored with fan disconnected, then the fan's control device, cable or connector is the culprit. Is both 5V and 12V DC current restored between test points after disconnecting fan?	Yes	Replace fan. Go to step 17.	X22
	No	No 5V DC or 12V DC from power supply. Replace power supply. Go to step 17.	P01



17. Verify issue resolved. Connect display to a known-good, supported Thunderbolt computer, and verify that all display features and ports are available. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

MagSafe Adapter Issues

Unlikely causes: camera, fan, LCD panel, logic board, microphone, speakers, subwoofer

Quick Check

Symptoms	Quick Check
MagSafe Adapter Issues <ul style="list-style-type: none">No power available on display's MagSafe connector.MagSafe connector LED does not illuminate.	<ol style="list-style-type: none">Verify that display is connected to a known-good electrical source with a known-good power cord.Verify that display's MagSafe connector is connected to a known-good portable computer.Check that MagSafe connector on cable and MagSafe port on computer are clean.Verify that MagSafe LED lights up green or amber when MagSafe connector is attached to a known-good portable computer.

Deep Dive

Check	Result	Action	Code
1. Inspect MagSafe cable and connector. Refer to Apple Support article TS1713: Apple Portables: Troubleshooting MagSafe adapters , and inspect MagSafe cable and computer's MagSafe port for physical damage, stuck pins, debris, or metal fragments. Is MagSafe cable connector damaged?	Yes	Replace All-In-One cable. Go to step 5.	X26
	No	Go to step 2.	



2. Check MagSafe cable on known-good computer. Attach MagSafe cable to known-good, supported portable computer. Verify that the MagSafe connector LED lights up green or amber, depending on charge status. Does the MagSafe connector LED illuminate either green or amber?	Yes	Go to step 4.	
	No	Go to step 3.	
3. Reset display's power. Unplug display's power cord, then plug it in again. Verify that display's MagSafe connector lights up green or amber depending on charge status. Does the MagSafe connector LED illuminate either green or amber?	Yes	Go to step 4.	
	No	Replace All-In-One cable. Go to step 5.	X03
4. Check power and charge functionality. Verify that display's MagSafe cable can provide enough power to a known-good portable computer (with a partially discharged battery) to simultaneously operate the computer and charge its battery to 100%. Does display's MagSafe cable charge the computer's battery while computer is fully operational?	Yes	The MagSafe power and charge features are functional. Go to step 5.	
	No	Replace power supply. Go to step 5.	P01
5. Verify issue resolved. Verify that display's MagSafe cable can provide enough power to a known-good portable computer (with a partially discharged battery) to simultaneously operate the computer and charge its battery to 100%. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



Sleep/Wake Issues

Unlikely causes: fan, microphone, speakers, subwoofer

Quick Check

Symptoms	Quick Check
Sleep/Wake Issues <ul style="list-style-type: none">• Won't go to sleep.• Won't wake from sleep.	<ol style="list-style-type: none">1. Verify that display is connected to a known-good electrical source with a known-good power cord.2. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)3. Verify Thunderbolt connector is fully seated.4. With display connected, check for and apply the latest software and firmware updates.5. Check brightness setting.6. Open Display Preferences (or press Option-F2) and check for presence of the middle Arrangement tab to confirm that display is recognized after wake-up.7. Verify that the sleep/wake issue also appears when running OS X. Sleep will be disabled when running Windows 7 with a Thunderbolt device connected. Review Apple Support article HT4617: Using Thunderbolt with Boot Camp and Windows 7.

Deep Dive

Check	Result	Action	Code
1. Check for Thunderbolt device presence. Unplug then re-plug Thunderbolt cable into known-good, supported computer. Check System Information (System Profiler in Snow Leopard) to verify that the display is listed in the Thunderbolt device tree. Does System Information (System Profiler) list the display?	Yes	Go to step 4.	
	No	Go to step 2.	



2. Check All-In-One cable connection to logic board. Remove glass and LCD panel. Verify that All-in-One cable uplink connection to logic board is secure. Is All-In-One cable connection secure?	Yes	Go to step 3.	
	No	Reseat All-in-One cable uplink connection to logic board and retest. Go to step 10.	
3. Test with known-good All-In-One cable. Substitute known-good All-in-One cable, run Software Update to verify that the latest cable firmware updates have been applied, then retest for sleep/wake issue. Does sleep/wake issue persist with known-good All-in-One cable?	Yes	Replace All-In-One cable. Go to step 10.	X03
	No	Replace logic board. Reinstall original All-In-One cable. Go to step 10.	M32
4. Check for DisplayPort LCD presence. Verify in System Information (System Profiler) > Graphics/Display device tree that the external display is shown as connected. Is external display listed in System Information (System Profiler)?	Yes	Go to step 6.	
	No	Go to step 5.	
5. Check internal DisplayPort cable and DisplayPort power cable connections. Remove glass and LCD panel. Verify if the internal DisplayPort cable and DisplayPort power cable connections between LCD panel and logic board are secure. Are cables connection secure?	Yes	Replace internal DisplayPort cable. Go to step 10.	X03
	No	Reseat cable connection(s) and retest. Go to step 10.	



6. Check for LCD panel backlight driver cable connection to logic board. Previous steps showed that the Thunderbolt connection to the logic board, and DisplayPort connection to LCD are functional, indicating that some power supply signals are present. Remove glass and LCD panel, then verify that the backlight driver cable connection between LCD and logic board is secure. Is backlight driver cable connection secure?	Yes	Go to step 7.	
	No	Reseat cable connection and retest. Go to step 10.	
7. Test for 24V DC presence for backlight. Reconnect external MagSafe and Thunderbolt cables to known-good computer, and reconnect display's power cord. Set digital multimeter to DC and correct range, then verify that the 23.3–25.7V DC current necessary for backlight power is present between logic board test point (24V DC) and chassis ground (GND). Is 24V DC power present on logic board test point?	Yes	Go to step 8.	
	No	Replace power supply. Go to step 10.	P02
8. Check power and charge functionality. Previous steps showed that 24V DC is available to logic board. Set digital multimeter to DC and correct range, and verify that a 11.4–12.6V DC current is present between logic board test point (12V DC) and chassis ground (GND). Is 12V DC power present on test point?	Yes	Go to step 9.	
	No	Replace power supply. Go to step 10.	P02



9. Try known-good All-In-One cable. Substitute known-good All-In-One cable and retest. Does sleep/wake issue persist?	Yes	Replace logic board. Reinstall All-In-One cable. Go to step 10.	M22
	No	Replace All-In-One cable. Go to step 10.	X03
10. Verify issue resolved. Connect a known-good, supported computer to the display, and verify that the computer can be put to sleep and woken up multiple times without issue. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Uncategorized Symptoms

Deep Dive

Check	Result	Action	Code
1. Verify whether existing symptom code applies to the issue reported by the user.	Yes	Jump to appropriate symptom code flow.	
	No	Document reported failure and send feedback to smfeedback6@apple.com stating that a suitable symptom code wasn't found. Contact TSPS for further troubleshooting support.	N99



Display Issues

Blank / No Video, No Backlight

Unlikely causes: camera, fan, microphone, speakers, subwoofer

Quick Check

Symptoms	Quick Check
Blank / No Video, No Backlight <ul style="list-style-type: none">No videoNo backlightDim backlight	<ol style="list-style-type: none">1. Verify that display is connected to a known-good electrical source with a known-good power cord.2. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)3. Verify that Thunderbolt cable is fully seated.4. To confirm that external display is recognized, open System Preferences > Displays (or press Option-F2), and verify that the middle Arrangement tab is present.5. Open System Preferences > Displays, and select Gather Windows to check for external display brightness setting.6. With display connected, check for and apply the latest software and firmware updates.

Deep Dive

Check	Result	Action	Code
1. Check display devices. Connect display to known-good power source. Connect Thunderbolt and MagSafe connectors to a known-good, supported computer. Verify that display's built-in camera and USB, FireWire and Ethernet ports are listed in their respective System Information (System Profiler in Snow Leopard) device trees. Are any of display devices listed in System Information (System Profiler)?	Yes	Go to step 2.	
	No	Go to No Power.	



2. Detect Thunderbolt device. Unplug and re-plug Thunderbolt connector into known-good, supported computer, and check computer's display for detection of external display. Does computer's display briefly turn off then back on when display is connected?	Yes	Go to step 11.	
	No	Go to step 3.	
3. Check cable connections. Remove glass, LCD panel and logic board to verify All-In-One cable uplink to back side of logic board. Also verify three cable connections between LCD panel and logic board. Are cables well-seated on both logic board and LCD panel?	Yes	Go to step 5.	
	No	Go to step 4.	
4. Reseat connections. Reseat All-In-One cable uplink connection to logic board, then reseat DisplayPort, DisplayPort power, and LED backlight driver cable connections between logic board and LCD panel. Reassemble and retest. Does video issue persist?	Yes	Go to step 5.	
	No	Issue resolved by reseating cables. Go to step 18.	
5. Check for cable damage. Closely inspect cables for damage. Are any cables damaged?	Yes	Go to step 6.	
	No	Go to step 8.	
6. Specify which cable is damaged. Determine which cable is damaged. Which cable is damaged: All-In-One cable or other cable?	All-In-One cable	Replace All-In-One cable. Go to step 18.	X26
	Other cable	Go to step 7.	



7. Specify which cable is damaged. Determine which cable is damaged. Which cable is damaged: All-In-One cable or other cable?	DisplayPort cable	Replace DisplayPort cable. Go to step 18.	X03
	DisplayPort Power cable	Replace DisplayPort power cable. Go to step 18.	X03
8. Try known-good DisplayPort cable. Substitute known-good DisplayPort cable and retest. Does video issue persist?	Yes	Go to step 9.	
	No	Replace DisplayPort cable. Go to step 18.	X03
9. Try known-good DisplayPort power cable. Substitute known-good DisplayPort power cable and retest. Does video issue persist?	Yes	Go to step 10.	
	No	Replace DisplayPort power cable. Reinstall user's DisplayPort cable. Go to step 18.	X03
10. Try known-good logic board. Substitute known-good logic board. Reconnect and reinstall LCD panel (making sure not to pinch LED backlight driver cable from LCD panel) and retest. Does video issue persist?	Yes	Replace LCD panel. Reinstall user's logic board, DisplayPort cable and DisplayPort power cable. Go to step 18.	L03
	No	Replace logic board. Reinstall user's DisplayPort cable and DisplayPort power cable. Go to step 18.	M03
11. Check for backlight but no video. If the blank/no video or no backlight issue persists, darken the room and connect display to a known-good, supported computer. Look for faint glow from display to verify that backlight is present. Can you detect some amount of illumination from the LCD in a dark room?	Yes	Replace LCD panel. Go to step 18.	L03
	No	Go to step 12.	



12. Check for video but no backlight. Shine bright (low heat) flashlight into the front of the LCD, and verify if any image is visible at all. Is a faint image visible on LCD?	Yes	Go to step 13.	
	No	Replace LCD panel. Go to step 18.	L03
13. Check for cable damage. Remove glass and LCD panel screws. Lift LCD panel to check LED backlight driver cable connection between logic board and LCD panel. See Functional Overview . Is LED backlight driver cable connection secure?	Yes	Go to step 14.	
	No	Reseat LED backlight driver cable connection to logic board. Go to step 18.	
14. Check backlight power voltage. Remove LCD panel. Set digital multimeter to DC and correct range (20). Verify that voltage reads 23.3–25.7V DC between logic board test point (24V DC) and ground (GND). Is voltage within 23.3–25.7V range between test points?	Yes	Go to step 15.	
	No	Replace power supply. Go to step 18.	P01
15. Check backlight driver cable for damage. Verify if LED backlight driver cable (part of the LCD panel) shows any signs of pinched or shorted wires. Also remove the logic board and verify if one or more of the three square inductors or adjacent components on top of logic board show signs of overheating. Is LED backlight driver cable damaged, or do any inductors show signs of overheating?	Yes	Go to step 16.	
	No	Go to step 17.	



16. Try known-good LCD panel. Substitute known-good LCD panel (making sure not to pinch LED backlight driver cable) and retest. Does backlight issue persist with known-good LCD panel?	Yes	Replace logic board. Reinstall user's LCD panel. Go to step 18.	M25
	No	Replace LCD panel. Go to step 18.	L14
17. Try known-good logic board. Substitute known-good logic board, reconnect and reinstall LCD panel, then retest. Does video issue persist?	Yes	Replace LCD panel. Reinstall user's logic board. Go to step 18.	L09
	No	Replace logic board. Go to step 18.	M25
18. Verify issue resolved. While connected to a known-good supported computer, verify that display is fully functional, even after waking computer from sleep. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



Noise / Unstable Flickering

Unlikely causes: camera, fan, microphone, speakers, subwoofer

Quick Check

Symptom	Quick Check
Noise / Unstable Flicker <ul style="list-style-type: none">• Image flickers• Audible noise	<ol style="list-style-type: none">1. Connect display to power and known-good, supported computer with Thunderbolt port.2. With display connected, check for and apply all available software and firmware updates to both the computer and the display.3. Check System Preferences > Displays to see if the "Automatically adjust brightness" ("Automatically adjust brightness as ambient light changes" in Snow Leopard) option is checked.4. Adjust display brightness from low to high, and check for a correlation with noise/backlight flicker issue.5. Noise: Check for correlation with fan operation. Fan is located in center behind LCD panel.6. Noise: Play audio from known-good sound source/file, and verify that it does not cause speaker distortion.

Deep Dive

Check	Result	Action	Code
1. Check for backlight-related issue. Using F1 and F2 keys, or in System Preferences > Displays, adjust brightness level from low to high. Check for correlation between brightness adjustment and noise. Does noise/flicker issue vary with brightness level adjustment?	Yes	Go to step 8.	
	No	Go to step 2.	



2. Check cable connections. Remove glass and LCD panel screws, then lift LCD panel. Verify if all connections between LCD panel, logic board, and power supply are secure. See Functional Overview . Does noise/flicker issue vary with brightness level adjustment?	Yes	Go to step 3.	
	No	Reseat cable connections. Go to step 11.	
3. Check for cable damage. Disconnect LED backlight driver, DisplayPort and DisplayPort power cables from logic board. Use magnification to examine cable connectors for damaged/bent pins, and inspect cables for pinching. Does noise/flicker issue vary with brightness level adjustment?	Yes	Go to step 4.	
	No	Go to step 6.	
4. Identify damaged cable. Specify which cable is damaged. Which cable or connector is damaged?	DisplayPort cable	Replace DisplayPort cable. Go to step 11.	X03
	Other cable	Go to step 5.	
5. Identify damaged cable. Specify which cable is damaged. Which cable or connector is damaged?	DisplayPort cable	Replace DisplayPort power cable. Go to step 11.	X03
	LED backlight driver cable	Cable is part of LCD panel. Replace LCD panel. Go to step 11.	L06
6. Test with known-good DisplayPort cable. Substitute known-good DisplayPort cable and retest. Is noise/flicker issue resolved?	Yes	Replace DisplayPort cable. Go to step 11.	X03
	No	Go to step 7.	



7. Test with known-good DisplayPort power cable. Substitute known-good DisplayPort cable and retest. Is noise/flicker issue resolved?	Yes	Replace DisplayPort cable. Go to step 11.	X03
	No	Go to step 7.	
8. Check for LED backlight driver cable damage. Use magnification to examine LED backlight driver cable and connector for pinching or damaged/bent pins. Are any wires or connector pins on the LED backlight driver cable damaged?	Yes	Replace LCD panel. Go to step 11.	L14
	No	Go to step 9.	
9. Verify issue at all backlight levels. Reseat LCD panel cable connections and retest to see if video noise/flicker issue appears at all backlight levels. Does issue persist at all backlight levels?	Yes	Replace logic board. Go to step 11.	M25
	No	Go to step 10.	
10. Verify issue at only low backlight levels. Determine if video noise/flicker issue appears at low backlight levels only. Does the issue appear only with low backlight levels?	Yes	Replace power supply. Go to step 11.	P04
	No	Retest for issue at all backlight levels. (Go back to step 9.)	
11. Verify issue resolved. Test display for several minutes at different backlight settings. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



Unstable Brightness / Brightness Progressively Getting Low

Unlikely causes: camera, fan, microphone, speakers, subwoofer

Quick Check

Symptom	Quick Check
Unstable Brightness / Brightness Progressively Getting Low <ul style="list-style-type: none">Brightness quickly or slowly varies.Brightness slowly decreases to a low level over time.	<ol style="list-style-type: none">1. Connect display to power and known-good, supported computer with Thunderbolt port.2. With display connected, check for and apply the latest software and firmware updates.3. Open System Preferences > Displays (or press Option-F2), and adjust Brightness.4. Check System Preferences > Displays to see if the "Automatically adjust brightness" ("Automatically adjust brightness as ambient light changes" in Snow Leopard) option is checked. If issue goes away when option is unchecked, consult Noise / Unstable Flickering.5. Verify that issue is not caused by lighting in user's environment.

Deep Dive

Check	Result	Action	Code
1. Set automatic brightness. Connect display to known-good, supported computer with current system software. Check System Preferences > Displays to see if the "Automatically adjust brightness" ("Automatically adjust brightness as ambient light changes" in Snow Leopard) option is checked. Cover camera / ambient light sensor with your hand. Does brightness vary accordingly?	Yes	Go to step 6.	
	No	Go to step 2.	



2. Check ALS presence on USB. Verify in System Information (System Profiler) > USB device tree that display's USB hub and built-in camera are listed. Does System Information (System Profiler) list USB hub and built-in camera?	Yes	Go to step 6.	
	No	Go to step 3.	
3. Reseat camera cable connections. Remove glass and LCD panel. Firmly reseat camera cable connectors to both camera and logic board, then retest. Does System Information (System Profiler) list USB hub and built-in camera?	Yes	Go to step 4.	
	No	Go to step 5.	
4. Try known-good camera cable. Substitute known-good camera cable and retest. Does System Information (System Profiler) list USB hub and built-in camera?	Yes	Replace camera cable. Go to step 13.	X03
	No	Replace camera and run EEPROM Reset Tool to calibrate new camera module (see camera take apart section). Go to step 13.	X20
5. Verify resolution. Retest, and if necessary, repeat previous step and test again. Is brightness issue resolved?	Yes	Issue resolved by reseating reseating camera and ALS connection. Go to step 13.	
	No	Go to step 6.	
6. Check LCD sensor cable connection. Ambient Light Sensor (located in camera) appears operational. Remove glass and LCD panel and verify that LCD sensor cable connection (on back of LCD panel) is secure and that sensor is fully covered with insulating foam. Is LCD sensor cable seated correctly and covered by foam insulator?	Yes	Go to step 9.	
	No	Go to step 7.	



7. Check for LCD sensor cable damage. Inspect LCD sensor cable for connector damage. Is LCD sensor cable damaged?	Yes	Replace LCD sensor cable. Go to step 13.	X03
	No	Go to step 8.	
8. Readjust LCD sensor cable foam. Reseat LCD sensor cable at top rear of LCD panel and adjust foam gasket around sensor (at bottom rear of LCD panel) to insulate it from internal ambient temperature. Retest. Is brightness issue resolved?	Yes	Issue resolved by reseating sensor cable and/or insulating foam gasket. Go to step 13.	
	No	Go to step 9.	
9. Listen for fan operation. Connect display to power and connect Thunderbolt cable to known-good (awake) computer. Put your ear to the back of the display near fan vent to listen closely for fan operation. Verify that fan is spinning. Does fan rotate when display is on?	Yes	Go to step 11.	
	No	Go to step 10.	
10. Reseat connection and check fan again. Reseat fan connection to logic board. Reconnect display to power and connect Thunderbolt cable to computer, then verify that fan is operating correctly. Does fan now rotate with display on?	Yes	Go to step 12.	
	No	Go to Fan Failures / Thermal Issues .	
11. Retest brightness as display warms up. Reinstall fan and LCD panel, and retest. Verify that brightness level remains consistent while display is warming up. Is brightness level stable as display warms up?	Yes	Brightness adjustment circuitry is not the issue. Go to Noise / Unstable Flickering .	
	No	Go to step 12.	



12. Try known-good LCD sensor cable. Fan is operating but brightness still fluctuates with temperature increase. Substitute known-good LCD sensor cable. Is brightness issue resolved?	Yes	Replace LCD panel. Go to step 13.	L07
	No	Replace LCD sensor cable. Go to step 13.	X03
13. Verify issue resolved. Retest display for several minutes. Verify that unstable brightness issue does not recur with increase in display temperature. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

LCD Image Issues

Quick Check

Symptom	Quick Check
LCD Image Issues <ul style="list-style-type: none">• Blank/no video, no backlight• Pixel anomalies• Non-uniform brightness• Incorrect/missing colors• Distorted/blurred image• Vertical/horizontal lines• Washed out or overall dominant color tint	<ol style="list-style-type: none">1. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source).2. With display connected, check for and apply the latest software and firmware updates.3. If used as second display, check System Preferences > Displays to see if the display's native resolution is correctly recognized.4. Check System Preferences > Displays > Color for an incorrect custom display profile.5. Check brightness setting.6. In System Preferences > Displays, uncheck "Automatically adjust brightness" option ("Automatically adjust brightness as ambient light changes" in Snow Leopard).7. Clean glass panel and check surface for dust or debris.



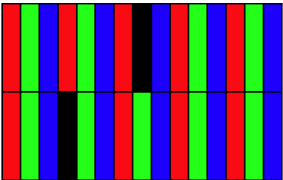
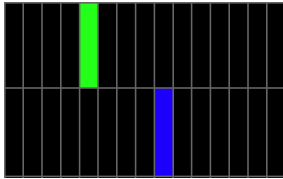
Deep Dive: General

Check	Result	Action	Code
1. Verify if issue is blank/no video.	Yes	Go to Blank/No Video, No Backlight.	
	No	Go to step 2.	
2. Verify if issue is bright or dark dot pixel anomalies.	Yes	Go to Pixel Anomalies.	
	No	Go to step 3.	
3. Verify if issue is non-uniform brightness.	Yes	Go to Non-Uniform Brightness.	
	No	Go to step 4.	
4. Verify if issue is incorrect/missing colors.	Yes	Go to Incorrect/Missing Colors.	
	No	Go to step 5.	
5. Verify if issue is distorted/blurred image.	Yes	Go to Distorted/Blurred Image.	
	No	Go to step 6.	
6. Verify if issue is vertical or horizontal lines.	Yes	Go to Vertical/Horizontal Lines.	
	No	Go to step 7.	
7. Verify if issue is display being washed out or tinted.	Yes	Go to Washed Out or Predominant Color Tint.	
	No	Symptoms cannot be reproduced, or else no troubleshooting is available for the specific LCD issue. Go to step 8.	
8. Verify issue resolved. Gather details regarding frequency of recurrence, and confirm that it can be reproduced while connected to a known-good computer. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



Deep Dive: Pixel Anomalies

Unlikely causes: camera, fan, logic board, microphone, power supply, speakers, subwoofer



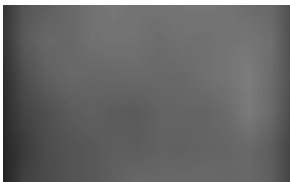
Check	Result	Action	Code
1. Check for debris on or under glass. Determine if “defects” are dust or debris trapped on or under surface of glass panel. Remove glass and verify if pixel anomalies remain when glass panel is removed. Are pixel anomalies still present after removing glass panel?	Yes	Go to step 2.	
	No	Go to step 3.	
2. Clean glass panel. Follow procedure to clean both sides of glass panel surface. Are pixel anomalies still present after removing glass panel?	Yes	Issue resolved by cleaning glass panel. Go to step 7.	
	No	Replace glass panel. Go to step 7.	X13
3. Check for dust or debris on LCD. Determine if “defects” are dust or debris on surface of LCD panel. Follow procedure to clean surface of LCD panel, and retest to see if pixel anomalies remain after cleaning. Are pixel anomalies still present after cleaning LCD?	Yes	Issue resolved by cleaning LCD panel. Go to step 7.	L08
	No	Go to step 4.	
4. Determine number of bright pixels. Determine if bright pixel defects exceed the acceptable number in Apple specifications. See Apple Support article HT4044: About LCD display pixel anomalies for Apple products released in 2010 and later . Does number of bright pixel defects exceed specifications?	Yes	Replace LCD panel. Go to step 7.	L08
	No	Go to step 5.	



5. Determine number of dark pixels. Determine if dark pixel defects exceed the acceptable number in Apple specifications. See Apple Support article HT4044: About LCD display pixel anomalies for Apple products released in 2010 and later . Does number of dark pixel defects exceed specifications?	Yes	Replace LCD panel. Go to step 7.	L08
	No	Go to step 5.	
6. Determine number of combined bright and dark pixels. Determine if bright pixel defects exceed the acceptable number in Apple specifications. See Apple Support article HT4044: About LCD display pixel anomalies for Apple products released in 2010 and later . Does number of bright and dark pixel defects combined exceed specification?	Yes	Replace LCD panel. Go to step 7.	L08
	No	Explain to user that LCD is within Apple specification for pixel defects. Do not replace LCD.	
7. Verify issue resolved. Reassemble display and retest. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Deep Dive: Non-Uniform Brightness

Unlikely causes: camera, fan, logic board, microphone, power supply, speakers, subwoofer



Check	Result	Action	Code
1. Allow for proper warmup time. Determine if brightness uniformity issue is present after display has warmed up for five minutes. Does brightness uniformity issue disappear after time to warm up?	Yes	Display backlight can take a few minutes to stabilize. Do not replace LCD panel. Go to step 8.	
	No	Go to step 2.	



2. Check for dust on glass. Determine if brightness uniformity is caused by dust or debris trapped on or under surface of glass panel. Remove glass and verify if brightness uniformity issue remains while glass panel is removed. Does brightness uniformity issue persist after removing glass panel?	Yes	Go to step 3.	
	No	Go to step 4.	
3. Clean glass panel. Follow procedure to clean both sides of glass panel surface. Is brightness uniformity issue resolved?	Yes	Issue resolved by cleaning glass panel. Go to step 8.	
	No	Replace glass panel. Go to step 8.	X13
4. Check for dust or debris on LCD. Determine if brightness uniformity is caused by dust or debris on surface of LCD panel. Follow procedure to clean surface of LCD panel, and retest to verify if brightness uniformity issue remains after cleaning. Does brightness uniformity issue persist after cleaning LCD panel?	Yes	Issue resolved by cleaning LCD panel. Go to step 8.	
	No	Go to step 5.	
5. Compare with known-good display. Compare user's display (or examples from user demonstrating brightness uniformity issue) to a known-good display. Determine if issue seems excessive compared to brightness uniformity of known-good display. Is issue excessive when compared to a similar display?	Yes	Go to step 6.	
	No	Brightness uniformity is consistent with that of a known-good display. Go to step 8.	



6. Check for mechanical interference. Remove front glass and loosen screws securing LCD panel. Does brightness uniformity improve when LCD panel screws are loosened?	Yes	Go to step 7.	
	No	Replace LCD panel. Go to step 8.	L08
7. Determine cause of interference. Remove LCD panel and inspect for source of mechanical interference. Check for screws/chassis/cables making contact with and applying pressure to the back of the LCD. Reinstall LCD panel and retest. Does reassembly improve brightness uniformity?	Yes	Issue resolved by removing source of mechanical interference. Go to step 8.	
	No	Replace LCD panel. Go to step 8.	L08
8. Verify issue resolved. Reassemble display and retest. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Deep Dive: Incorrect/Missing Colors

Unlikely causes: camera, fan, microphone, logic board, power supply, speakers, subwoofer

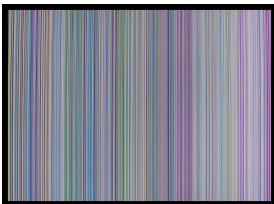
Check	Result	Action	Code
1. Verify display profile. Using known-good system, check System Preferences > Displays > Color, and select valid display profile. Does a valid profile resolve the issue?	Yes	Issue resolved with correct display profile. Go to step 5.	
	No	Go to step 2.	
2. Check for cable damage. Remove glass and LCD panel. Check that all cable wires and connectors between LCD and logic board—including All-In-One cable—are free of damage. See Functional Overview . Are any cables damaged?	Yes	Replace damaged cable. Go to step 5.	X03
	No	Go to step 3.	



3. Reseat cables. Firmly reseat all cable connections between LCD panel and logic board, as well as the All-In-One cable. See Functional Overview . Does reseating cables resolve the issue?	Yes	Issue resolved by cable reseat. Go to step 5.	
	No	Go to step 4.	
4. Compare with known-good display. Position user's display next to a known-good display with each displaying the same image. Verify if the issue is noticeably worse on the display being tested. Is issue visibly worse on user's display?	Yes	Replace LCD panel. Go to step 5.	L02
	No	Small variations in color uniformity are normal and do not warrant replacement or repair of the display. Go to step 5.	
5. Verify issue resolved. Reassemble display and retest. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Deep Dive: Distorted/Blurred Image

Unlikely causes: camera, fan, microphone, logic board, power supply, speakers, subwoofer



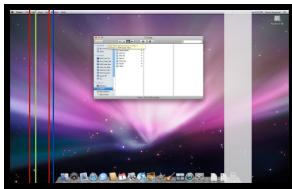
Check	Result	Action	Code
1. Verify display profile. Using known-good system, check System Preferences > Displays > Color, and select valid display profile. Does a valid profile resolve the issue?	Yes	Issue resolved with correct display profile. Go to step 4.	
	No	Go to step 2.	
2. Check for cable damage. Remove glass and LCD panel. Check that all cable wires and connectors between LCD and logic board—including All-In-One cable—are free of damage. See Functional Overview . Are any cables damaged?	Yes	Replace damaged cable. Go to step 4.	X03
	No	Go to step 3.	



3. Reseat cables. Firmly reseat all cable connections between LCD panel and logic board, as well as the All-In-One cable. See Functional Overview . Does reseating cables resolve the issue?	Yes	Issue resolved by cable reseat. Go to step 4.	
	No	Replace LCD panel. Go to step 4.	L04
4. Verify issue resolved. Reassemble display and retest. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Deep Dive: Vertical/Horizontal Lines

Unlikely causes: Camera, fan, microphone, logic board, power supply, speakers, subwoofer



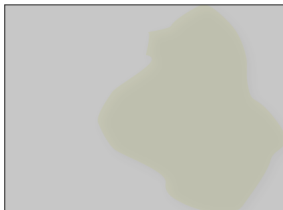
Check	Result	Action	Code
1. Check for display detection. Unplug and re-plug Thunderbolt connector into known-good, supported computer with Thunderbolt port, and check computer's display for detection of external Thunderbolt display. Does computer's display briefly turn off then back on when Thunderbolt display is connected?	Yes	Go to step 2.	
	No	Replace All-In-One cable. Go to step 4.	X03
2. Check for cable damage. Remove glass and LCD panel. Check that all cable wires and connectors between LCD and logic board—including All-In-One cable—are free of damage. See Functional Overview . Are any cables damaged?	Yes	Replace damaged cable. Go to step 5.	X03
	No	Go to step 3.	



3. Reseat cables. Firmly reseat all cable connections between LCD panel and logic board, as well as the All-In-One cable. See Functional Overview . Does reseating cables resolve the issue?	Yes	Issue resolved by cable reseat. Go to step 4.	
	No	Replace LCD panel. Go to step 4.	L02
4. Verify issue resolved. Reassemble display and retest. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Deep Dive: Washed Out or Predominant Color Tint

Unlikely causes: camera, fan, microphone, logic board, power supply, speakers, subwoofer



Check	Result	Action	Code
1. Update software and firmware. With display connected to a known-good, supported computer, check for and apply the latest software and firmware updates. Is the issue resolved?	Yes	Issue resolved by updating software or firmware. Go to step 5.	
	No	Go to step 2.	
2. Check for low brightness. In System Preferences > Displays, set brightness slider to maximum setting and retest. Does adequate brightness resolve the issue?	Yes	Brightness was set too low to compensate for ambient room lighting. Issue resolved by increasing brightness. Go to step 5.	
	No	Go to step 3.	
3. Turn off automatic brightness. Check System Preferences > Displays to see if the “Automatically adjust brightness” (“Automatically adjust brightness as ambient light changes” in Snow Leopard) option is checked. If so, disable the setting, then retest. Does disabling automatic brightness resolve the issue?	Yes	Go to Unstable Brightness / Brightness Progressively Getting Low .	
	No	Replace LCD panel.	L05



4. Verify issue resolved. Reassemble display and retest. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Physical Damage

Quick Check

Symptom	Quick Check
Physical Damage <ul style="list-style-type: none">Cracked LCDScratched LCD polarizerScorched or melted LCDImpact damage to LCD, glass or rear housing	<ol style="list-style-type: none">Determine the cause of damage: user, technician, environment, accidental damage or abuse.Inform user that display failures due to accidental damage are not covered, and if applicable, discuss out-of-warranty repair options. Refer to Apple Support article CP161: SERVICE: Determining and Quoting Accidental Damage.

Uncategorized Symptoms

Deep Dive

Check	Result	Action	Code
1. Verify whether existing symptom code applies to the issue reported by the user.	Yes	Jump to appropriate symptom code flow.	
	No	Document the reported failure and send feedback to smfeedback6@apple.com stating that a suitable symptom code wasn't found. Contact TSPS for further troubleshooting support.	L99



Input/Output Issues

USB Issues

Unlikely causes: camera, fan, LCD panel, microphone, speakers, subwoofer

Quick Check

Symptoms	Quick Check
USB Issues <ul style="list-style-type: none">• External USB device(s) not recognized• Wired USB keyboard/mouse not recognized• USB-based iPod, iPhone or iPad not charging	<ol style="list-style-type: none">1. Check user's USB cable(s) and connectors for damage. Do not connect damaged cables to display or computer.2. Verify USB device by connecting it directly to a known-good computer.3. Verify that display is connected to a known-good electrical source with a known-good power cord.4. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)5. Check that display is functional and displays a video signal from the connected computer.6. Verify known-good USB device on display's USB ports.7. Check System Information (System Profiler in Snow Leopard) > USB device tree to see if computer recognizes display's internal USB devices: USB hub, USB audio in/out, and FaceTime HD camera.8. With display connected, check for and apply the latest software and firmware updates.9. Check to see if user's USB device requires a specific device driver to function properly.

Deep Dive

Check	Result	Action	Code
1. Check USB ports on display. Inspect all USB ports on back of display under magnification for damaged or bent pins. Are any USB ports damaged?	Yes	Go to step 4.	
	No	Go to step 2.	



2. Check for accidental damage. Look for dents, scratches, or other indications of impact or abuse in or around USB ports in rear housing. Can issue be attributed to accidental damage?	Yes	Go to step 3.	
	No	Replace logic board. Go to step 8.	M24
3. Explain accidental damage options. Using Apple Support article CP161: SERVICE: Determining and Quoting Accidental Damage as a guide, inform user that display failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options. Does user want to proceed with out-of-warranty repair?	Yes	Replace logic board. Go to step 8.	M24
	No	Issue resolved. Return display to user with appropriate positioning.	
4. Check MagSafe power. Connect power cord to display then connect MagSafe to known-good portable computer. Verify that the MagSafe connector LED is either green or amber. Is MagSafe LED green or amber?	Yes	Go to step 5.	
	No	Go to No Power .	
5. Check USB power. Leave power cord connected to display but disconnect All-in-One cable from connected computer. Connect a known-good USB-based iPod, iPhone or iPad to display. Does device show any sign of power or charge from display's USB port?	Yes	Go to step 6.	
	No	Go to No Power .	



6. Check internal USB device presence. Connect display's All-in-One cable to known-good computer. Check System Information (System Profiler) > USB device tree to see if computer recognizes internal USB devices: USB hub, USB audio in/out, and FaceTime HD camera. Does System Information (System Profiler) list any of these ports or devices?	Yes	Go to step 7.	
	No	Replace All-In-One cable. Go to step 8.	X26
7. Check external USB device presence. Connect a known-good USB device to USB ports on back of display. In System Information (System Profiler), select File menu > Refresh (or relaunch System Information), and verify that USB device appears in USB device tree. Does System Information (System Profiler) list the USB device?	Yes	Troubleshoot user's device, or direct user to: - contact USB device manufacturer for support; - verify system requirements and device compatibility; - and find out if the device requires additional software.	
	No	Replace logic board. Go to step 8.	M24
8. Verify issue resolved. Retest display with multiple known-good USB devices. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



FireWire Issues

Unlikely causes: camera, fan, LCD panel, microphone, speakers, subwoofer

Quick Check

Symptoms	Quick Check
FireWire Issues <ul style="list-style-type: none">• FireWire device(s) not recognized when connected to display's FireWire ports.• FireWire device(s) have no or limited functionality when connected to display's FireWire ports.	<ol style="list-style-type: none">1. Check user's FireWire cable(s) and connectors for damage. Do not connect damaged cables to display or computer.2. Verify FireWire device by connecting it directly to a known-good computer.3. Verify that display is connected to a known-good electrical source with a known-good power cord.4. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)5. Check that display is functional and displays a video signal from the connected computer.6. Verify known-good FireWire device on the display's FireWire port.7. Check System Information (System Profiler in Snow Leopard) > USB device tree to see if computer recognizes display's internal USB devices: USB hub, USB audio in/out, and FaceTime HD camera.8. With display connected, check for and apply the latest software and firmware updates.9. Check if user's FireWire device requires a specific software driver to function properly.

Deep Dive

Check	Result	Action	Code
1. Check FireWire port on display. Inspect FireWire port on back of display under magnification for damaged/bent pins. Is FireWire port free from damage?	Yes	Go to step 4.	
	No	Go to step 2.	



2. Check for accidental damage. Look for dents, scratches, or other indications of impact or abuse in or around FireWire port in rear housing. Can FireWire port or connector damage be attributed to accidental damage?	Yes	Go to step 3.	
	No	Replace logic board. Go to step 8.	M24
3. Explain accidental damage options. Using Apple Support article CP161: SERVICE: Determining and Quoting Accidental Damage as a guide, inform user that display failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options. Does user want to proceed with out-of-warranty repair?	Yes	Replace logic board. Go to step 8.	M24
	No	Return display to user.	
4. Check internal devices detection. Connect display's All-in-One cable to known-good computer. Check System Information (System Profiler) > USB device tree to see if computer recognizes internal USB devices: USB hub, USB audio in/out, and FaceTime HD camera. Does System Information (System Profiler) list any of these ports or devices?	Yes	Go to step 5.	
	No	Replace logic board. Go to step 8.	M12



5. Check FireWire device presence. Connect a known-good FireWire device to FireWire port on back of display. In System Information (System Profiler), select File menu > Refresh (or relaunch System Information), and verify that FireWire device appears in USB device tree. Does System Information (System Profiler) list the FireWire device?	Yes	Go to step 6.	
	No	Replace logic board. Go to step 8.	M12
6. Check FireWire port functionality. Try connecting known-good FireWire device to FireWire port on back of display. Verify that the device behaves as if it were directly connected to a computer. Does known-good FireWire device function normally?	Yes	Troubleshoot user's device, or direct user to: - contact FireWire device manufacturer for support; - verify system requirements and device compatibility; - and find out if the device requires additional software.	
	No	Go to step 7.	
7. Try known-good All-In-One cable. Substitute a known-good All-In-One cable. Run Software Update to check for and apply the latest cable firmware. Reassemble display and reconnect known-good FireWire device. Verify that it behaves as if it were connected directly to computer. Does known-good All-In-One cable restore FireWire functionality ?	Yes	Replace All-In-One cable. Go to step 8.	X26
	No	Replace logic board. Reinstall original All-In-One cable. Go to step 8.	M30
8. Verify issue resolved. Retest display with multiple known-good FireWire devices. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



Thunderbolt Issues

Unlikely causes: camera, fan, LCD panel, microphone, speakers, subwoofer

Quick Check

Symptoms	Quick Check
Thunderbolt Issues <ul style="list-style-type: none">External Thunderbolt device(s) not recognized when connected to display's Thunderbolt ports.	<ol style="list-style-type: none">Note: This display does not support Mini DisplayPort devices connected to its rear Thunderbolt port. (This is different behavior than Thunderbolt-capable computers, which do support Mini DisplayPort devices.)Check user's Thunderbolt cable(s) and connectors for damage. Do not connect damaged cables to display or computer.Verify Thunderbolt device(s) by connecting them directly to a known-good supported computer.Verify that display is connected to a known-good electrical source with a known-good power cord.Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)Check that display is functional and displays a video signal from the connected computer.Verify known-good Thunderbolt devices on the display's Thunderbolt port.Check System Information (System Profiler in Snow Leopard) > USB device tree to see if computer recognizes display's internal USB devices: USB hub, USB audio in/out, and FaceTime HD camera.For any new device connected to the display's Thunderbolt port, check for and apply the latest software and firmware updates.Check to see if user's Thunderbolt device requires a specific software driver to function properly.



Deep Dive

Check	Result	Action	Code
1. Check Thunderbolt port on logic board. Inspect Thunderbolt port on back of display under magnification for damaged/ bent pins. Is Thunderbolt port free from damage?	Yes	Go to step 4.	
	No	Go to step 2.	
2. Check for accidental damage. Look for dents, scratches, or other indications of impact or abuse in or around Thunderbolt port in rear housing. Can Thunderbolt port damage be attributed to accidental damage?	Yes	Replace logic board. Go to step 8.	M24
	No	Go to step 3.	
3. Explain accidental damage options. Using Apple Support article CP161: SERVICE: Determining and Quoting Accidental Damage as a guide, inform user that display failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options. Does user want to proceed with out-of-warranty repair?	Yes	Replace logic board. Go to step 8.	M24
	No	Return display to user.	
4. Check internal devices detection. Connect display's All-In-One cable to a known-good supported computer and run System Information (System Profiler) to verify that display's USB hub, display's USB audio in/ out, FaceTime HD camera appear in the USB device tree. Does any of these ports and devices appear in System Info USB device tree?	Yes	Go to step 5.	
	No	Replace All-In-One cable. Go to step 8.	X26



5. Check Thunderbolt device presence. Connect a known-good Thunderbolt device to Thunderbolt port on back of display. In System Information (System Profiler), select File menu > Refresh (or relaunch System Information), and verify that Thunderbolt device appears in device tree. Does System Information (System Profiler) list the Thunderbolt device?	Yes	Go to step 6.	
	No	Replace logic board. Go to step 8.	M30
6. Check Thunderbolt port functionality. Try connecting known-good Thunderbolt device to Thunderbolt port on back of display. Verify that the device behaves as if it were directly connected to a computer. Does known-good Thunderbolt device function normally?	Yes	Troubleshoot user's device, or direct user to: - contact Thunderbolt device manufacturer for support; - verify system requirements and device compatibility; - and find out if the device requires additional software.	
	No	Go to step 7.	
7. Try known-good All-In-One cable. Substitute a known-good All-In-One cable. Run Software Update to check for and apply the latest cable firmware. Reassemble display and reconnect known-good Thunderbolt device. Verify that it behaves as if it were connected directly to computer. Does known-good All-In-One cable restore Thunderbolt functionality ?	Yes	Replace All-In-One cable. Go to step 8.	X26
	No	Replace logic board. Reinstall original All-In-One cable. Go to step 8.	M30
8. Verify issue resolved. Retest display with multiple known-good Thunderbolt devices. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



Camera Issues

Unlikely causes: fan, LCD panel, microphone, power supply, speakers, subwoofer

Quick Check

Symptom	Quick Check
Camera Issues <ul style="list-style-type: none">• FaceTime HD Camera not detected by PhotoBooth or iChat application• No green camera LED (when camera is activated via PhotoBooth or iChat)• Excessive blooming• Poor white balance• Poor focus• Image distortion	<ol style="list-style-type: none">1. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)2. Check that display is functional and displays a video signal from the connected computer.3. Check System Information (System Profiler in Snow Leopard) > USB device tree to see if computer recognizes display's internal USB devices: USB hub, USB audio in/out, FaceTime HD camera, etc.4. With display connected, check for and apply the latest software and firmware updates.5. Verify that both camera lens and glass panel are clear of dust or contaminants.

Deep Dive

Check	Result	Action	Code
1. Check display's USB hub presence. Connect display's Thunderbolt connector to known-good computer. Check System Information (System Profiler) > USB device tree for display's USB hub, USB audio in/out, and FaceTime HD camera. Does System Information (System Profiler) list display's internal USB devices?	Yes	Go to step 2.	
	No	Go to USB Issues .	



2. Check USB camera presence. Verify in System Information (System Profiler) that display's FaceTime HD camera is listed in USB device tree. Is FaceTime HD camera device listed in System Information (System Profiler)?	Yes	Go to step 4.	
	No	Go to step 3.	
3. Check camera cable connections. Remove glass panel and LCD panel, then reseal camera cable connectors to both camera and logic board. Reinstall LCD panel and retest. Is FaceTime HD camera device listed in System Information (System Profiler)?	Yes	Issue resolved by reseating camera cable. Go to step 10.	
	No	Replace camera cable. Go to step 10.	X03
4. Check camera activation. Launch PhotoBooth, and select display's FaceTime HD camera in the Devices menu. Verify that the green LED near the camera lens lights up. Does the green camera LED illuminate when PhotoBooth is launched?	Yes	Go to step 5.	
	No	Replace camera, then run EEPROM Reset Tool (see camera take apart section). Go to step 10.	X21
5. Check camera functionality. Use PhotoBooth to verify that camera is picking up an image. Does PhotoBooth display an image from the camera?	Yes	Go to step 6.	
	No	Replace camera, then run EEPROM Reset Tool (see camera take apart section). Go to step 10.	X21
6. Check camera functionality. Verify that camera image in PhotoBooth is in focus and free of visual defects. Does image appear normal?	Yes	Camera appears to be functional. Go to step 10.	
	No	Go to step 7.	
7. Check glass panel. Remove glass panel and see if camera image in PhotoBooth is now free of defects. Is the image normal when the glass panel is removed?	Yes	Go to step 9.	
	No	Go to step 8.	



8. Clean camera lens. Use a soft, lint-free cloth to clean the camera lens. Verify in PhotoBooth if the camera image is now free of defects. Is the image normal after cleaning the camera lens?	Yes	Issue resolved by cleaning camera lens. Go to step 10.	
	No	Replace camera, then run EEPROM Reset Tool (see camera take apart section). Go to step 10.	X20
9. Clean glass panel. Use a soft, lint-free cloth to clean both sides of glass panel. Reinstall the panel and verify in PhotoBooth if the camera image is now free of defects. Is the image normal after cleaning the glass panel?	Yes	Issue resolved by cleaning glass panel. Go to step 10.	
	No	Replace camera, then run EEPROM Reset Tool (see camera take apart section). Go to step 10.	X20
10. Verify issue resolved. Reassemble display and retest. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



Audio-Out / Speakers Issues

Unlikely causes: camera, fan, power supply

Quick Check

Symptoms	Quick Check
Audio-Out / Speakers Issues <ul style="list-style-type: none">• Display audio output not available in System Preferences > Sound > Output• No sound• No bass• No treble• Sound limited to one side• Garbled sound	<ol style="list-style-type: none">1. Verify that display is connected to a known-good electrical source with a known-good power cord.2. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)3. Check that display is functional and displays a video signal from the connected computer.4. Check System Information (System Profiler in Snow Leopard) > USB device tree to see if computer recognizes display's internal USB devices: USB hub, USB audio in/out, and FaceTime HD camera.5. Verify that System Preferences > Sound > Output is set to display's Audio and that Output volume 'mute' option is not checked. Adjust Output volume slider to compensate for room noise.6. Verify that audio player application equalizer and preamp gain settings are set to default.7. With display connected, check for and apply the latest software and firmware updates.

Deep Dive

Check	Result	Action	Code
1. Check internal devices detection. Connect display's All-in-One cable to known-good computer. Check System Information (System Profiler) > USB device tree to see if computer recognizes internal USB devices: USB hub, USB audio in/out, and FaceTime HD camera. Does System Information (System Profiler) list any of these ports or devices?	Yes	Go to step 2.	
	No	Go to USB Issues .	



2. Confirm audio-out issue. Determine if user-reported issue is related to display's audio-out / speakers (rather than internal microphone). Is the issue specific to audio-out?	Yes	Go to step 3.	
	No	Go to Audio-In / Microphone Issues .	
3. Verify display's audio output selection and setup. In System Preferences > Sound > Output, verify Output is set to display's Audio Output. Play a known-good audio file, and move balance control left then right to verify that sound plays normally through both left and right speakers. Does symptom occur when display's Audio Output is selected in System Preferences?	Yes	Go to step 4.	
	No	Issue seems unrelated to display's audio-out interface. Go to step 8.	
4. Check for speakers cable damage. Inspect internal left, right, and subwoofer speaker cables, connectors and logic board connector ports for damage. Are any cables or connectors damaged?	Yes	Replace affected speaker. Go to step 8.	X09
	No	Go to step 5.	
5. Reseat speaker connections. Reseat left, right, and subwoofer speaker cables connectors to logic board. Reassemble display and retest. Is issue resolved after reseating speaker cables?	Yes	Issue resolved with cable reseat. Go to step 8.	
	No	Go to step 6.	
6. Verify left and right speakers. Play a known-good sound file while adjusting balance control left to right to verify that sound plays normally from left and right speakers. Does issue occur only through left or right speaker?	Yes	Replace affected speaker. Go to step 8.	X09
	No	Go to step 7.	



7. Verify subwoofer. Remove LCD panel, disconnect subwoofer, then reconnect and reinstall LCD panel. Retest. Does audio issue persist when subwoofer is disconnected?	Yes	Replace logic board. Go to step 8.	M09
	No	Replace subwoofer. Go to step 8.	X09
8. Verify issue resolved. Retest display speakers using multiple known-good audio sources. Make sure to check both left and right channels. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Audio-In / Microphone Issues

Unlikely causes: camera, fan, power supply, speakers, subwoofer

Quick Check

Symptoms	Quick Check
Audio-In / Microphone Issues <ul style="list-style-type: none">Display's audio input not available in System Preferences > Sound > InputDisplay's internal microphone input does not show any activity	<ol style="list-style-type: none">Verify that display is connected to a known-good electrical source with a known-good power cord.Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)Check that display is functional and shows a video signal from the connected computer.Check System Information (System Profiler in Snow Leopard) > USB device tree to see if computer recognizes display's internal USB devices: USB hub, USB audio in/out, and FaceTime HD camera.Verify that System Preferences > Sound > Input is set to display's Audio Input. Adjust Input Volume slider and test microphone functionality by tapping lightly on a faraway surface or making subtle background noise.With display connected, check for and apply the latest software and firmware updates.



Deep Dive

Check	Result	Action	Code
1. Confirm audio-in issue. Determine if user-reported issue is related to display's audio-in / internal microphone (rather than audio-out / speakers). Is the issue specific to audio-in?	Yes	Go to step 2.	
	No	Go to Audio-Out / Speakers Issues .	
2. Verify display's audio input selection and setup. Launch System Preferences > Sound > Input and verify that: - display's Audio Input is selected, - input volume slider is set above minimum, - and Input Level indicator moves when speaking into microphone located at top of display near camera. Does Input Level indicator move in tandem with incoming sound?	Yes	Go to step 5.	
	No	Go to step 3.	
3. Check for microphone cable damage. Closely inspect internal microphone cable routing for pinched cabling and inspect cable connector and logic board connector for damage. Is the microphone cable or any of its connectors damaged?	Yes	Replace rear housing (which includes microphone). Go to step 6.	X03
	No	Go to step 4.	
4. Reseat microphone cable connection. Reseat microphone cable connection to logic board. Reassemble display and retest. Is issue resolved after reseating microphone cable?	Yes	Issue resolved by reseating microphone cable connection. Go to step 6.	
	No	Replace rear housing (which includes microphone). Go to step 6.	X03



5. Verify recording quality. Launch QuickTime Player, and select New Audio Recording (in File menu). Select display's audio input (in popup menu on right side of window), then click Record button to create a sound sample, speaking directly into the microphone (located on top of display near camera). Verify that playback sound quality is normal. Is sound quality of recorded audio clear and free of distortion?	Yes	Microphone functionality appears to be within specifications. Go to step 6.	
	No	Replace rear housing (which includes microphone). Go to step 6.	X03
6. Verify issue resolved. Retest display's microphone. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Uncategorized Symptoms

Deep Dive

Check	Result	Action	Code
1. Verify whether existing symptom code applies to the issue reported by the user.	Yes	Jump to appropriate symptom code flow.	
	No	Document reported failure and send feedback to smfeedback6@apple.com stating that a suitable symptom code wasn't found. Contact TSPS for further troubleshooting support.	N99



Communications Issues

Ethernet Issues

Unlikely causes: camera, fan, LCD panel, microphone, speakers, subwoofer

Quick Check

Symptoms	Quick Check
Ethernet Issues <ul style="list-style-type: none">• Ethernet port not available• Ethernet cable not detected when connected to Ethernet port• Ethernet device unable to obtain an IP address• Unable to access Ethernet network resources• Slow Ethernet network performance	<ol style="list-style-type: none">1. Verify that display is connected to a known-good electrical source with a known-good power cord.2. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)3. Check that display is functional and displays a video signal from the connected computer.4. Test with known-good network hardware and Ethernet cable (Cat-5 or better is recommended for 100+ Mbps connections).5. Verify network setup by accessing it directly via known-good computer's Ethernet port.6. Check for and apply the latest software and firmware updates.7. Launch System Information (System Profiler in Snow Leopard) and verify that display's Ethernet port appears in Network devices tree.8. Check System Information (System Profiler) > Network to see if display's Ethernet port is listed.9. Connect a network cable to the display's Ethernet port. In System Information (System Profiler), select File menu > Refresh (or relaunch System Information), then select Network > Ethernet to verify that a valid IP address has been assigned.



Deep Dive

Check	Result	Action	Code
1. Check display's Ethernet port. Inspect Ethernet port on back of display under magnification for damaged or bent pins. Is Ethernet port damaged?	Yes	Go to step 4.	
	No	Go to step 2.	
2. Check for accidental damage. Look for dents, scratches, or other indications of impact or abuse in or around Ethernet port in rear housing. Can issue be attributed to accidental damage?	Yes	Go to step 3.	
	No	Replace logic board. Go to step 8.	M24
3. Explain accidental damage options. Using Apple Support article CP161: SERVICE: Determining and Quoting Accidental Damage as a guide, inform user that display failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options, and refer to CP152: SERVICE: Accidental Damage Repair Pricing for Mail-In Notebooks and Displays for pricing. Does user want to proceed with out-of-warranty repair?	Yes	Replace logic board. Go to step 8.	M24
	No	Issue resolved. Return display to user with appropriate positioning.	
4. Check internal devices detection. Connect display's All-In-One cable to a known-good, supported computer. Check System Information (System Profiler) to verify that display's USB hub, USB audio in/out, or FaceTime HD camera appear in USB device tree. Are any of these ports or devices listed in display's USB device tree?	Yes	Go to step 5.	
	No	Replace All-In-One cable. Go to step 8.	X26



5. Check Ethernet network accessibility. Connect to a network with a known-good DHCP server (no MAC address filtering) with known-good Ethernet cable inserted in port on back of display. In System Preferences > Network > Ethernet, verify that: - display's Ethernet port appears, - its link status is "Connected" (green dot), - and a valid IP address is listed (depending on network, DHCP allocation may not be instantaneous). Retest. Do known-good Ethernet network and valid IP address appear in System Preferences > Network > Ethernet?	Yes	Go to step 6.	
	No	Replace logic board. Go to step 8.	M10
6. Check network connection. Using a simple hub/switch environment, consult System Preferences > Network > Ethernet to obtain router IP address. Use Network Utility to ping the router. Is Network Utility able to ping the router's IP address?	Yes	Go to step 7.	
	No	Replace logic board. Go to step 8.	M10
7. Compare network performance. Perform network test from previous step using same cable and network, but directly connected to known-good computer's Ethernet port. Is display's Ethernet showing inferior network performance compared to known-good computer?	Yes	Replace logic board. Go to step 8.	M10
	No	No performance or connectivity issues detected. No repair necessary. The problem may be the network environment. Refer user to Apple Support article TS1317: Mac OS X: Troubleshooting a cable modem, DSL, or LAN Internet connection.	



8. Verify issue resolved. 1. Connect Ethernet cable to known-good network with DHCP server. 2. In System Preferences > Network > Ethernet port (for display), verify that link status is "Connected" (green dot). 3. Configure TCP/IP settings to "Using DHCP" and check that a valid IP address is obtained from server (not self-assigned address starting with 169.254.x.x). 4. Launch web browser and verify that computer can access websites and download files.. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Uncategorized Symptoms

Deep Dive

Check	Result	Action	Code
1. Verify whether existing symptom code applies to the issue reported by the user.	Yes	Jump to appropriate symptom code flow.	
	No	Document reported failure and send feedback to smfeedback6@apple.com stating that a suitable symptom code wasn't found. Contact TSPS for further troubleshooting support.	N99



Mechanical Issues

Noise / Hum / Vibration

Unlikely causes: All-In-One cable, camera, LCD panel, logic board

Quick Check

Symptoms	Quick Check
Noise / Hum / Vibration <ul style="list-style-type: none">• Buzzing noise• Rattling noise• Ticking noise• Squeaking noise	<ol style="list-style-type: none">1. Verify that display is connected to a known-good electrical source with a known-good power cord.2. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)3. With display connected, check for and apply all available software and firmware updates to both the computer and the display.4. Check that display is functional and displays a video signal from the connected computer.5. Tilt display back and forth to the full range of its hinge to determine if mechanical noise is generated by the hinge mechanism. Repair or replace hinge mechanism if needed.6. Play a known-good sound sample at both soft and loud volume levels to determine whether noise is caused by left/right/subwoofer speakers or by amplifier circuit. See Audio Issues.7. Check air intake/outflow vents for obstructions, which could cause the fan to run at high speeds.8. With display connected, check for and apply the latest software and firmware updates.



Deep Dive

Check	Result	Action	Code
1. Check for speaker-related noise. Disconnect internal left, right and subwoofer speaker cables from logic board. Reconnect MagSafe and Thunderbolt connectors to a known-good, supported portable computer. Verify if noise has disappeared. Does noise persist with speakers disconnected?	Yes	Go to step 2.	
	No	Go to Audio-Out / Speakers Issues .	
2. Verify fan, power supply and LCD sensors. Reconnect left, right, and subwoofer cable connectors to logic board. Verify that fan and power supply sensor cables are correctly positioned and securely connected to logic board. Verify that LCD sensor is securely seated in its connector on back of LCD panel and properly protected by insulating foam gasket. Are all sensors correctly positioned and firmly seated?	Yes	Issue resolved.	
	No	Reseat sensor cable connectors and adjust their positions, securing any foam insulators, then retest. Go to step 7.	
3. Check for excessive fan speed. Determine if noise is caused by the fan running unusually fast. Is fan running at high speed?	Yes	Replace fan sensor cable. Go to step 7.	X03
	No	Go to step 4.	
4. Check fan for damaged blades. Remove fan and inspect blades for damage. Is fan free of damage?	Yes	Go to step 5.	
	No	Replace fan. Go to step 7.	X23
5. Check fan for obstructions. Remove fan and rotate its blades. Remove any dust or debris. Verify that blades spin smoothly without any interference from fan housing. Do fan blades spin smoothly?	Yes	Go to step 6.	
	No	Replace fan. Go to step 7.	X23



6. Check fan seating interference. Reinstall fan, making sure no cables are routed under or near fan assembly and interfering with fan mechanism. Verify that noise is resolved after reassembly. Is noise resolved by reseating the fan?	Yes	Issue resolved by reseating fan in its enclosure.	
	No	Replace fan. Go to step 7.	X23
7. Verify issue resolved. Reassemble display and retest. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	

Burnt Smell / Odor

Unlikely causes: LCD panel, fan, camera, speakers, subwoofer, microphone

Quick Check

Symptoms	Quick Check
Burnt Smell / Odor <ul style="list-style-type: none">No power and burnt smell or odorNo image and burnt smell or odorNo fan spin and burnt smell or odor	<ol style="list-style-type: none">Disconnect power cord and peripherals from display and Thunderbolt cable from computer.Verify if source of smell or odor is emanating from the display.Determine if this is a safety issue. Refer to Apple Support article CP1124: SERVICE: Handling Potential Product Safety Issues.Inspect enclosure for smoky residue or other obvious signs of burning. Check bottom and rear vents, rear ports and MagSafe connector as well as power cord.Check for indications of accidental damage or liquid spill, and if found, determine whether damage was caused by user, technician or environment.Clean enclosure to eliminate causes due to external contamination.Check vents for any obstructions and verify that air can flow freely into and out of the display.



Deep Dive

Check	Result	Action	Code
1. Check for safety issue. Closely inspect display and cables for a possible safety issue. Have you identified a safety issue?	Yes	Contact TSPS for any safety-related issues. Refer to Apple Support article CP1124: SERVICE: Handling Potential Product Safety Issues .	
	No	Go to step 2.	
2. Check for external contamination. Odor can be related to external contamination. Inspect exterior of display for contamination or lack of cleanliness. Can you determine that the odor is caused by external contamination?	Yes	Go to step 3.	
	No	Go to step 4.	
3. Clean display exterior. Thoroughly clean enclosure and all external surfaces. Refer to Apple Support article HT3226: How to clean Apple products . Explain the cause to the user. Does user agree that the odor is due to external contamination?	Yes	Issue resolved. Go to step 6.	
	No	Escalate to TSPS.	
4. Check if product is new. Odors can be related to how new the product is. Refer to Apple Support article HT4921: New equipment: Odors may be present short-term . Can you determine that the odor is due to newness?	Yes	Go to step 5.	
	No	Go to step 6.	



5. Explain cause of odor. Explain to user that new equipment can sometimes emit an odor, similar to odors generated from new carpeting or a new car. In most cases the odor dissipates after a brief period. Refer user to Apple Support article HT4921: New equipment: Odors may be present short-term . Does user agree that odor is related to display's newness?	Yes	Issue resolved. Go to step 6.	
	No	Escalate to TSPS.	
6. Check for internal damage or contamination. Remove glass and LCD panels and closely inspect internal components and enclosure for indications of physical damage or contamination. Can you identify signs of internal damage or contamination?	Yes	Refer to Apple Support article CP161: SERVICE: Determining and Quoting Accidental Damage .	
	No	Go to step 7.	
7. Verify issue resolved. Closely inspect internal hardware and enclosure for other possible causes of odor, such as bulging or vented capacitor chips, visible residue and/or burn marks on the enclosure, logic board or other components. Have you identified a component failure as the source of the odor?	Yes	Escalate to TSPS.	
	No	Go to step 8.	
8. Verify issue resolved. Connect display to supported computer. Run computer for several hours and monitor for issue or odor. If no functional failure is detected, use correct positioning to explain to user that odor is related to external contamination or newness of display. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



Fan Failures / Thermal Issues

Unlikely causes: camera, LCD panel, microphone, speakers, subwoofer

Quick Check

Symptoms	Quick Check
Fan Failures / Thermal Issues <ul style="list-style-type: none">• Washed out image• No, slow or fast fan spin• Excessive heat exhaust• Eventual shutdown of display	<ol style="list-style-type: none">1. Check that the display is on a stable work surface that allows for adequate air circulation under and around the display.2. Remove any air vent obstructions.3. Verify that display is connected to a known-good, supported computer with Thunderbolt port. (This display does not support a Mini DisplayPort source.)4. Check that display is functional and displays a video signal from the connected computer.5. With display connected, check for and apply the latest software and firmware updates.

Deep Dive

Check	Result	Action	Code
1. Verify seating of sensor cables. Disconnect power cord, then remove glass and LCD panel. Verify that: <ul style="list-style-type: none">- fan sensor cable is correctly positioned on fan and connected to logic board;- power supply sensor cable is correctly positioned on rear housing and connected to logic board;- LCD sensor cable is securely seated in its connector on back of LCD panel, and protected from ambient temperature by its insulating foam gasket. Are the three sensor cables correctly seated?	Yes	Go to step 3.	
	No	Go to step 2.	



2. Check sensor cables for damage. Closely inspect connectors and cables of all three thermal sensors—fan, power supply and LCD—for indications of physical damage. Are any cables or connectors damaged?	Yes	Refer to Apple Support article CP161: SERVICE: Determining and Quoting Accidental Damage .	
	No	Reseat sensor cable connectors and adjust their positions, securing any foam insulators, then retest. Go to step 12.	
3. Verify pressure wall seating. Verify that pressure wall section attached to fan is securely seated in rear housing. Is pressure wall properly seated in rear housing?	Yes	Go to step 4.	
	No	Secure the pressure wall onto rear housing. Go to step 12.	
4. Verify air separation foam. Check for presence and proper seating of air separation foam pads (located on back of LCD panel) that align with pressure walls in rear housing. Is air separation foam correctly seated on back of LCD?	Yes	Go to step 5.	
	No	Reseat air separation foam pads to align them with the pressure walls and restore the sealing between each side of the air pressure walls. Go to step 12.	
5. Verify fan operation. Determine if fan is running abnormally fast, too slow or not running at all. Is fan running fast, or is it slow or stopped?	Fast	Go to step 6.	
	Slow or stopped	Go to step 9.	
6. Verify fan speed control. Unplug power cord and leave display off for a few minutes. Connect it to a known-good, supported computer with Thunderbolt, then plug in power cord. Check to see if fan starts up at full speed as soon as display is on. Does fan run at full speed immediately upon reconnecting power?	Yes	Go to step 8.	
	No	Go to step 7.	



7. Verify that fan speed correlates with thermal variation. Connect USB device such as iPhone or iPad for battery recharge. Verify that fan speed progressively ramps up after some usage or charge time. Does fan speed incrementally increase after some usage or charge?	Yes	It is expected behavior for the fan to adjust its speed with thermal sensor input. Go to step 12.	
	No	Replace fan sensor cable. Go to step 12.	X03
8. Verify fan connection. Verify that fan cable is securely connected to logic board. Is the fan securely connected?	Yes	Replace fan. Go to step 12.	X22
	No	Reseat fan cable connection to logic board. Go to step 12.	
9. Verify fan connection. Verify that fan cable is securely connected to logic board. Is the fan securely connected?	Yes	Go to step 10.	
	No	Reseat fan cable connection to logic board. Go to step 12.	
10. Check fan for obstructions. Remove fan and rotate its blades. Remove any dust or debris. Verify that blades spin smoothly without any interference from fan housing. Do fan blades spin smoothly when removed from enclosure?	Yes	Go to step 11.	
	No	Fan rotor blocked. Replace fan. Go to step 12.	X22
11. Check fan seating interference. Reinstall fan, making sure no cables are routed under or near fan assembly and interfering with fan mechanism. Verify that noise is resolved after reassembly. Is issue resolved after reseating fan?	Yes	Issue resolved by reseating fan. Go to step 12.	
	No	Replace fan. Go to step 12.	X22
12. Verify issue resolved. Reassemble display and retest. Is the issue resolved?	Yes	Issue resolved.	
	No	Escalate to TSPS.	



Mechanical/Physical Damages

Quick Check

Symptoms	Quick Check
Mechanical/Physical Damages <ul style="list-style-type: none">• Broken glass• Bent stand• Broken hinge• Stripped screw/head/boss• Dent or scratch to exterior• Damaged cable/connector	<ol style="list-style-type: none">1. Inspect display and discuss nature of issue with user.2. Determine whether user wants to proceed with repair (despite possible accidental damage) or pursue other service options.3. Proceed with further troubleshooting.

Deep Dive

Check	Result	Action	Code
1. Identify affected part(s). Determine whether cause has already been isolated to a single damaged part. Has issue been identified?	Yes	Go to step 2	
	No	Jump to appropriate symptom code flow most closely related to the user's reported symptom(s).	
2. Verify source of damage. Determine cause of damage or defects: user/technician, environment, accidental damage or abuse. Is an Apple agent responsible for the damage or defect on the computer?	Yes	Contact TSPS to continue with troubleshooting process.	
	No	Proceed with resolution using proper positioning. Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to www.apple.com/legal/warranty .	



Uncategorized Symptoms

Deep Dive

Check	Result	Action	Code
1. Verify whether existing symptom code applies to the issue reported by the user.	Yes	Jump to appropriate symptom code flow.	
	No	Document reported failure and send feedback to smfeedback6@apple.com stating that a suitable symptom code wasn't found. Contact TSPS for further troubleshooting support.	X99

Take Apart

Thunderbolt Display (27-inch)



General Information

Opening the Unit

- The Thunderbolt Display (27-inch) has a glass panel that attaches to the front, which must be removed prior to replacing any module on the unit.
- **Important:** The glass panel should only be removed by Apple-authorized technicians. Follow all cleaning and handling instructions to prevent damaging glass panel or LCD panel.
- Follow ESD precautions when glass panel is removed.

For more information about ESD, refer to Apple Support article:

[HT3451: Electrostatic Discharge Precautions and Myths](#)

[AppleCare Service Training: ESD Precautions](#)

Required Tools

The following tools are required to service a Thunderbolt Display (27-inch):

- ESD-safe workstation, including an ESD mat and wrist or heel strap
- ESD bags (for storing ESD-sensitive parts while removed from unit)
- Magnetized Torx T10 screwdriver
- Magnetized Phillips #0 screwdriver
- Black stick (nylon probe, Apple part #922-5065) or other non-conductive nylon or plastic flat-blade tool
- Access card (Apple part #922-7172)
- Clutch mechanism retrieval tool (Apple part #922-7849)
- Thermal paste syringe (Apple part #922-9625) for camera reassembly
- Thunderbolt and USB cables for logic board reassembly alignment
- Kapton tape
- Digital volt meter (for troubleshooting)
- Soft, clean towel or cloth (to protect display and removed parts from scratches)

Required Special Tools for Glass Panel

Special tools are required to remove, handle and clean glass panel.

- 922-8252 – Suction cups, Pkg of 2
- 922-8253 – Gloves, lint-free, anti-static, Pkg of 2
- 922-8261 – Sticky silicone roller (6-inch) to clean glass panel
- 922-8262 – Sticky sheet pads to clean silicone roller
- 922-8263 – Polishing cloths, anti-static, optical-grade micro-terry, Pkg of 5
- 922-9275 – Microfoam bag (large) to store glass panel, Pkg of 5



Cleaning Tools Starter Kit

The following tools are offered in the cleaning starter kit (076-1277):

- Suction cups, 1 pair
- Gloves, lint-free, anti-static, 2 pairs
- Sticky silicone roller (6-inch) to clean glass panel
- Sticky sheets to clean the silicone roller, 2 pads
- Polishing cloths, clean, anti-static, optical-grade micro-fiber “terry” style, 5 cloths
- Microfoam bag to store glass panel, 5 bags
- ESD bag for LCD panel storage, 5 bags

Cleaning & Handling Glass Panel

Follow cleaning procedures in this manual to ensure glass panel is free of dust and other particles before returning the display to user.

- The glass panel is not tempered and will break into sharp pieces if mishandled. A scratched or broken glass panel is not covered under warranty.
- Removing glass panel requires special tools such as lint-free gloves, rubber suction cups, and microfoam storage bags.
- To prevent contamination, wear lint-free gloves and handle glass only by edges.

Do's and Don'ts

DO

- Handle glass panel using lint-free gloves.
- Use only a sticky silicone roller to clean the inside surface of glass and LCD panel.
- Place glass panel into a clean protective microfoam bag when removed from unit.
- Store glass panel in a safe area where it will not be broken or damaged.
- Store LCD panel in an anti-static bag to prevent buildup of static charges which may attract dust particles to display's surface.
- Store silicone roller and sticky paper within a temperature range of 39-104 F (5-40 C).
- If silicone roller is no longer tacky, wash it in warm soapy water or wipe with isopropyl alcohol. If tackiness does not return, replace silicone roller.

DON'T

- Touch inside of glass with bare hands or dirty gloves. Fingerprints are difficult to remove.
- Place glass panel onto a work surface where it may collect dust and other contaminants unless it has first been placed into a protective microfoam bag.

Handling a Broken Glass Panel

The glass panel is not tempered and will break into sharp pieces if mishandled. If the glass is broken it must be carefully removed from the unit to prevent irreparable damage to the front surface of the LCD. If the front surface of the LCD is scratched by broken glass, the LCD may need to be replaced.



How to Remove a Broken Glass Panel

A shattered panel can be removed using safety glasses, packing tape, and leather gloves.

1. Put on the safety glasses and leather gloves.
2. Lay the computer on a smooth, clean work surface.

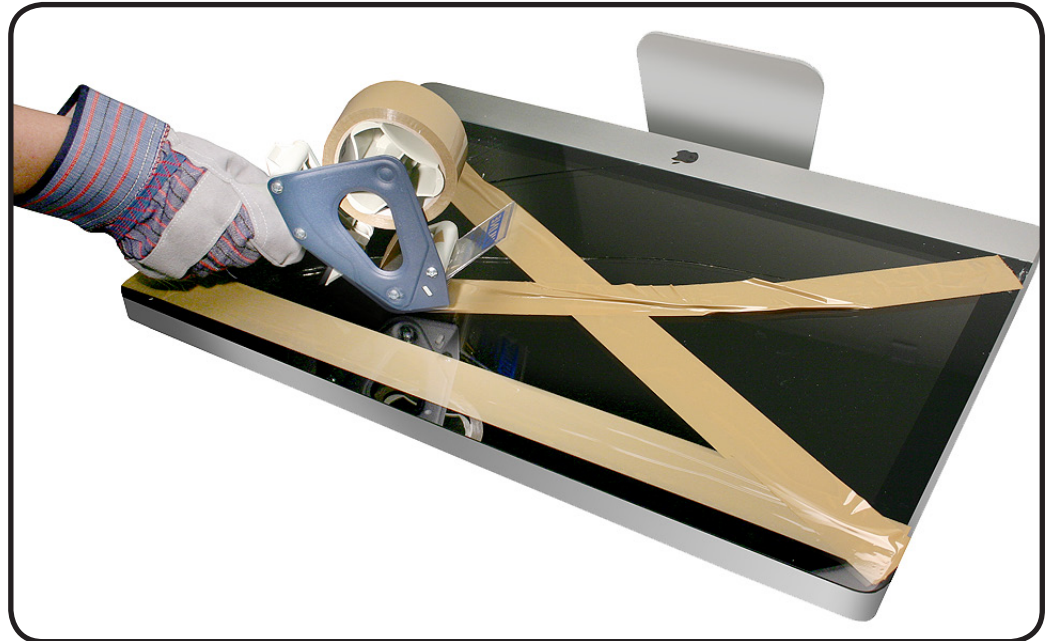


3. Peel protective covering off the front of the glass. Remove and discard any large pieces of broken glass.





4. Apply a strip of packing tape horizontally across the top and bottom of the glass panel. Next, apply the tape diagonally, across the broken glass panel, forming an "X."



5. Continue applying tape horizontally, thoroughly covering the broken glass. Most of the glass will still be attached to the steel ring that runs around the perimeter of the glass panel.

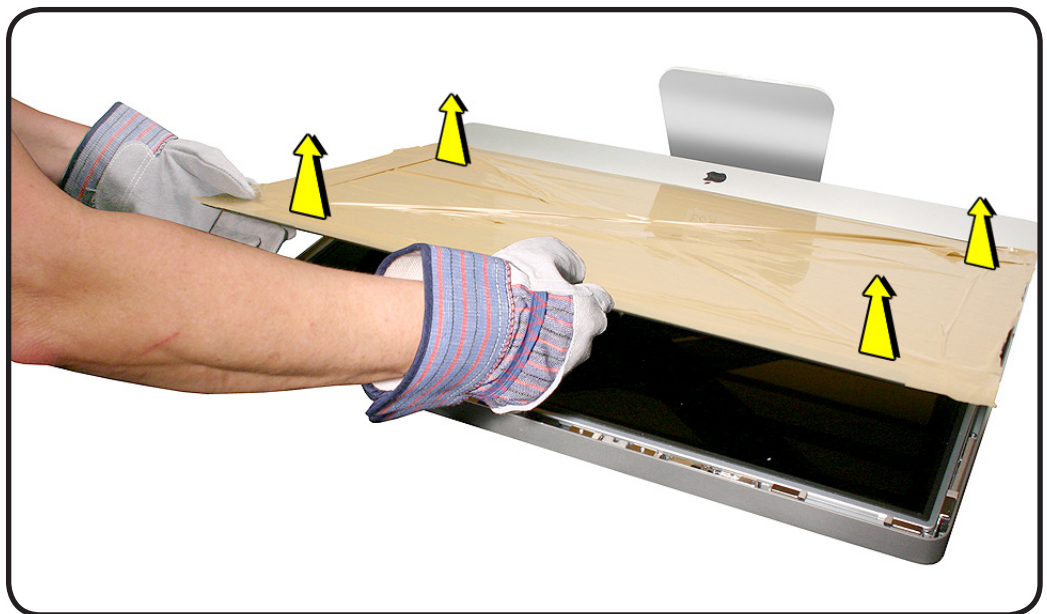




6. Use a black stick to pry the glass panel off the magnets on the rear housing.



7. Lift the entire glass panel off the rear housing.





8. Place the broken glass inside a large box, label the box, and dispose of it properly.



9. Using a whisk broom, clean the work surface of tiny glass particles.
10. Stand the display up and use a lint free cloth to carefully brush any of the particles off the display onto the table. Clean the work surface again.
11. When the repair is finished the cloth should be disposed of immediately.
12. Use a broom and dustpan to sweep up as much of the broken glass as possible. Glass fragments may have traveled several feet from the location of the glass panel, so be sure to thoroughly clean the entire area. Use a vacuum to remove the smaller fragments not picked up by the broom.

Note: A broken glass panel may leave one or more scratches on the LCD display depending on the severity of the glass breakage. As long as the LCD itself has not been fractured the LCD does not require replacement, but be sure to let the customer know that the scratches are there and were caused by the broken glass panel.



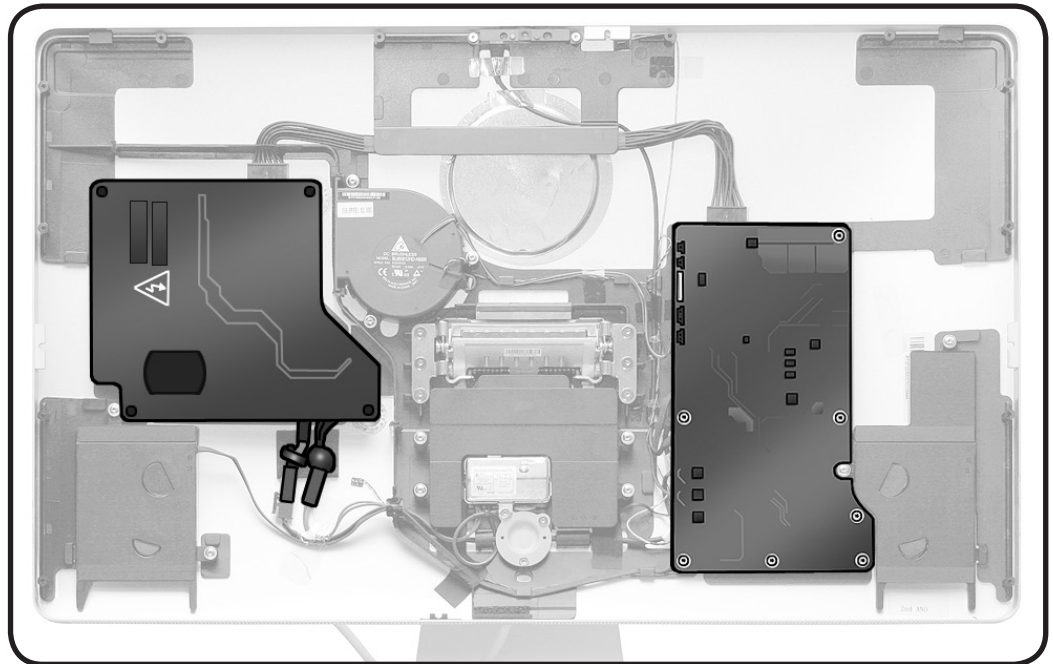
Safety



Warning: HIGH VOLTAGE: The AC/DC power supply board and logic board remain powered up whenever the system is plugged in. Use extreme caution when troubleshooting the display with glass panel and LCD panel removed.

- Don't work alone. In the event of electrical shock it is important to have another individual present who can provide assistance.
- Keep one hand in your pocket when working on any unit that is plugged in. This will help ensure that your body does not provide a path to ground in the event that you accidentally make contact with line voltage.
- Don't wear jewelry, watches, necklaces, or other metallic articles that could present a risk if they accidentally make contact with power supply circuitry.

Important: Wait one (1) hour after unplugging the computer from the electrical outlet before removing the power supply or working near the power supply leads. The power supply contains a high voltage capacitor that may remain charged for up to an hour after unplugging the computer.



Reassembly Steps

When no replacement steps are listed, replace parts in exact reverse order of Removal procedure.

Note About Images in This Guide

There may be slight differences in appearance between the image pictured and the unit you are servicing. Although the appearance may differ slightly, the steps and sequence are the same unless noted.

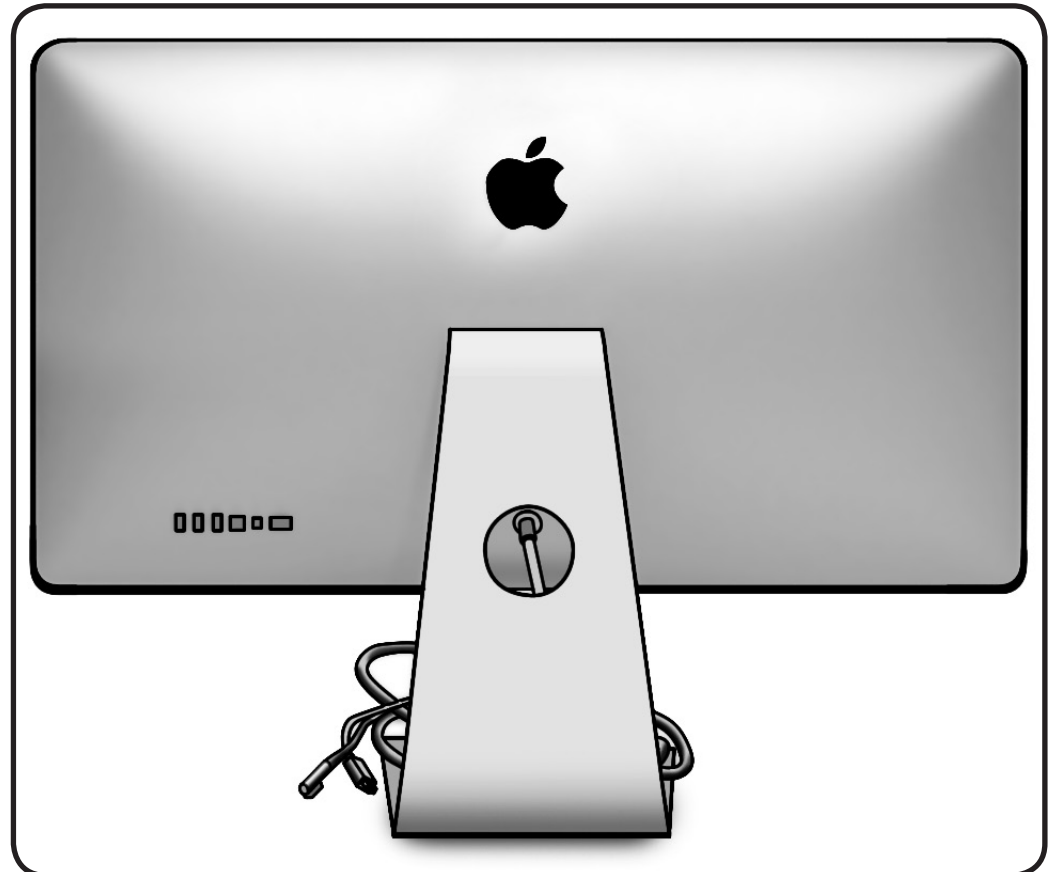


Stand

First Steps

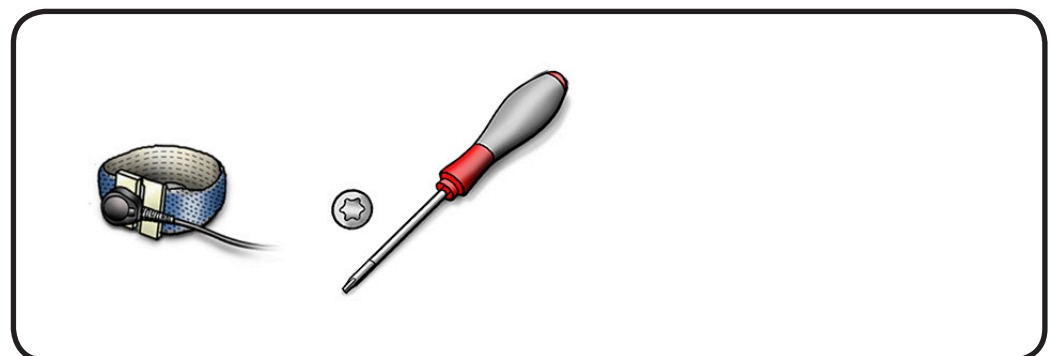
No preliminary steps are required to remove the stand.

Note: The stand screws cannot be removed from inside the rear housing.



Tools

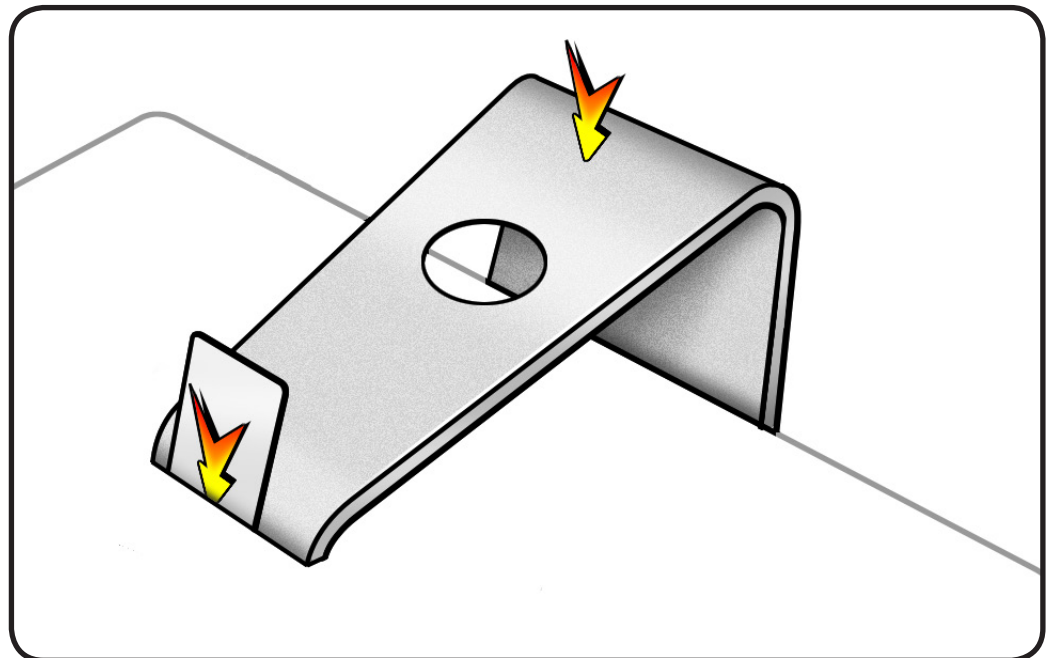
- ESD wrist strap
- Torx T10 screwdriver
- Access card
(Apple part #922-7172)



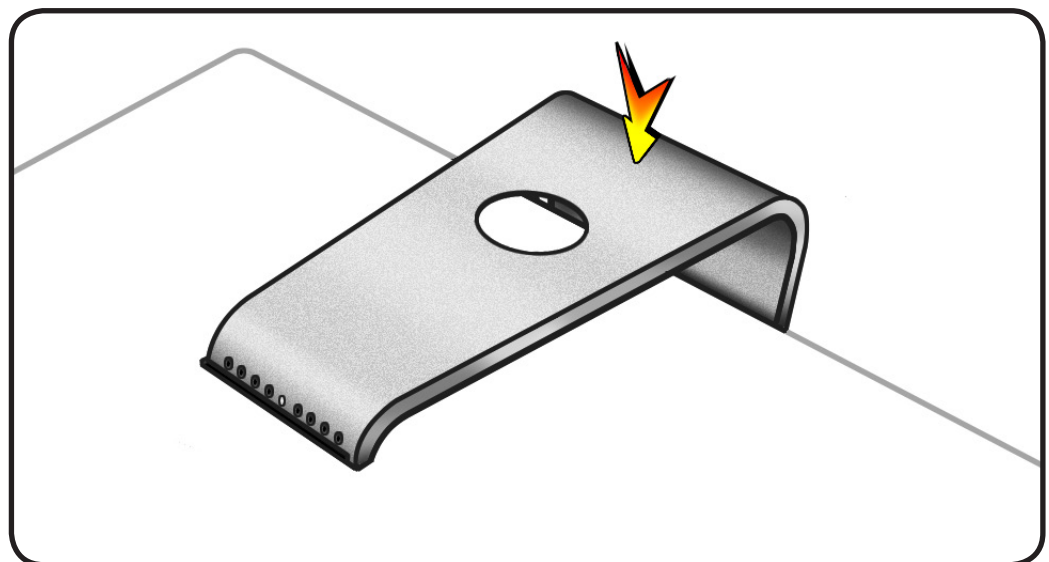


Removal

- 1 Place display face down on a table so that base of stand extends over table edge.
- 2 Press stand down and insert access card into slot between top of stand and rear housing.



- 3 Insert card as far as it will go, and press stand down until you hear a click—the audible cue that tells you that stand is locked into place.
- 4 Remove access card.

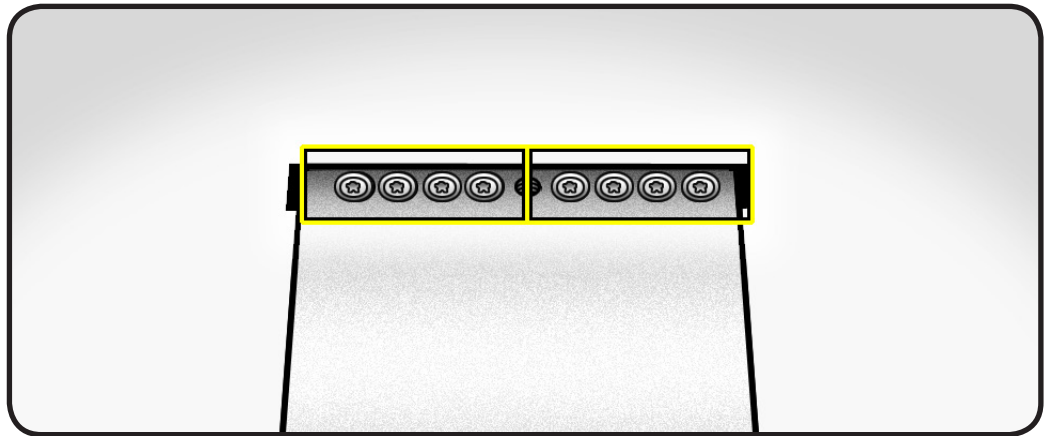




- 5** Remove T10 screws:
(8) 922-8749



- 6** Separate stand from
clutch mechanism.



Reassembly

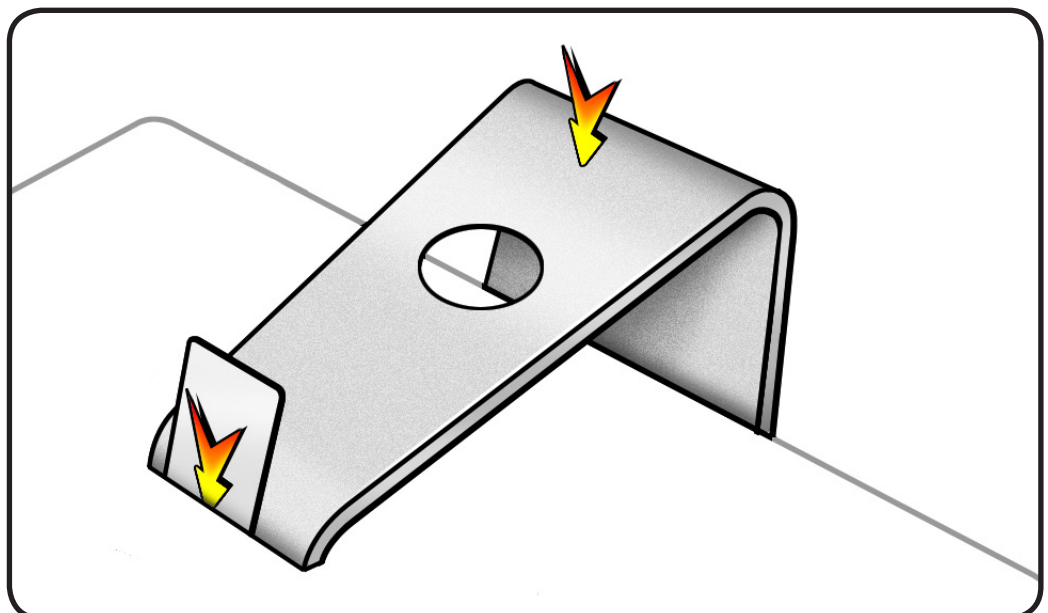
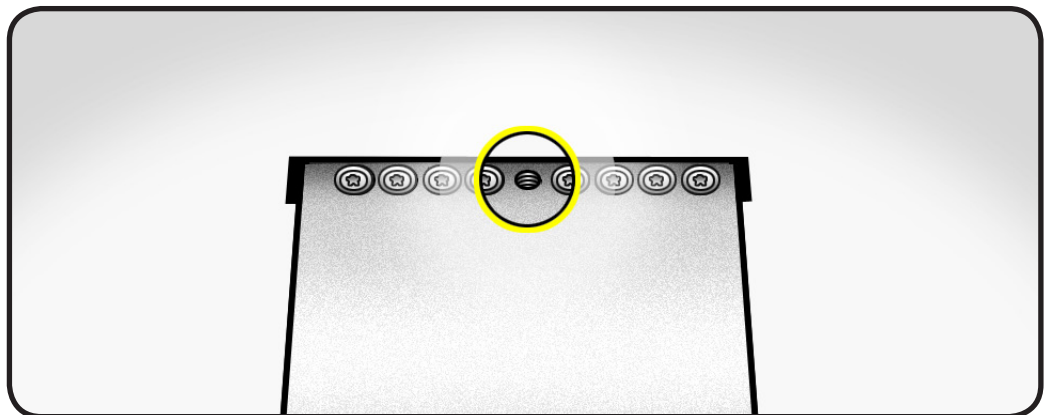
- 1** Place display face
down on a table.
Align pin on
mechanism to central
hole in stand.

- 2** Replace 8 T10 screws.

- 3** Place display so that
base of stand extends
over table edge. Press
stand down and
insert access card into
slot between top
of stand and rear
housing.

- 4** Insert access card
as far as it will go.
Gently lift stand
approximately two
inches to unlock
mechanism, and then
remove access card.
Mechanism should
now be unlocked.

- 5** Stand display upright.





Glass Panel

First Steps

- Unplug all cables and the power cord.
- Put on ESD strap.

Caution: The glass panel is not tempered and will break into sharp pieces if mishandled. A scratched or broken glass panel is not covered by warranty.

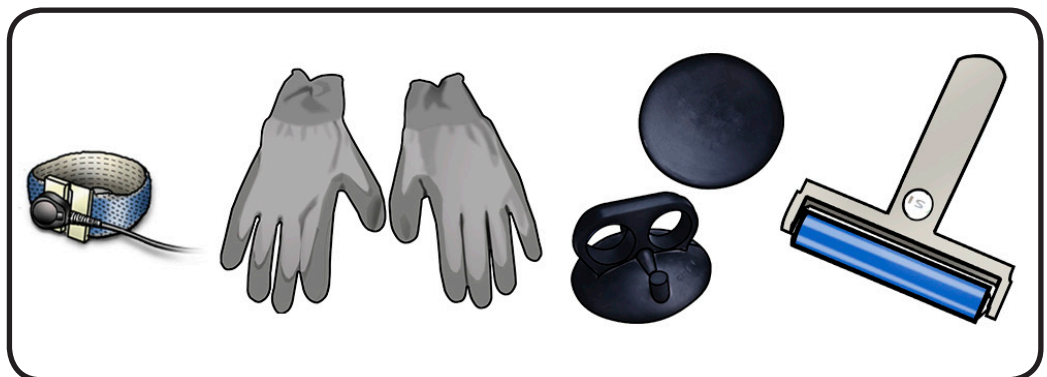
Important:

This procedure requires special tools, which are offered individually or as part of a cleaning kit. See [General Take Apart](#) section for details.



Tools

- ESD wrist strap
- lint-free gloves
- suction cups
- sticky silicone roller
- sticky sheets to clean the silicone roller
- microfoam bag to store glass panel



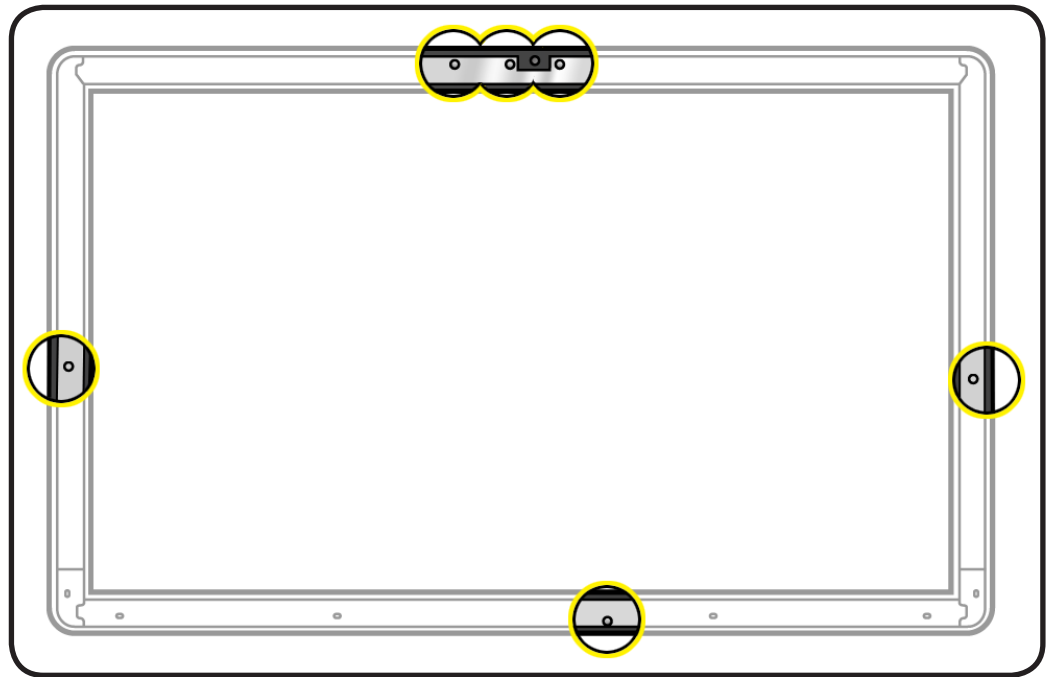


Removal

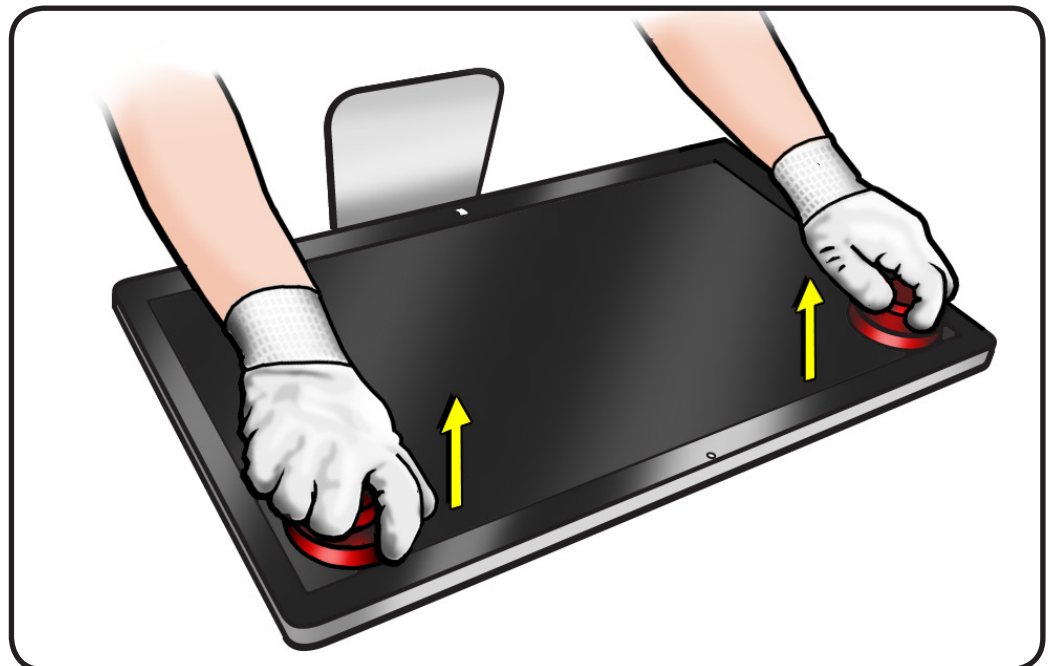
Note: Glass panel is held in place by magnets.

Note: There are guide pins on back of glass panel. Be careful not to bend or break guide pins during removal or installation. If any pins are missing, check for loose metal pieces inside unit and replace glass panel.

Apple strongly recommends wearing clean, lint-free gloves whenever handling the glass panel, to reduce cleaning required on reassembly.



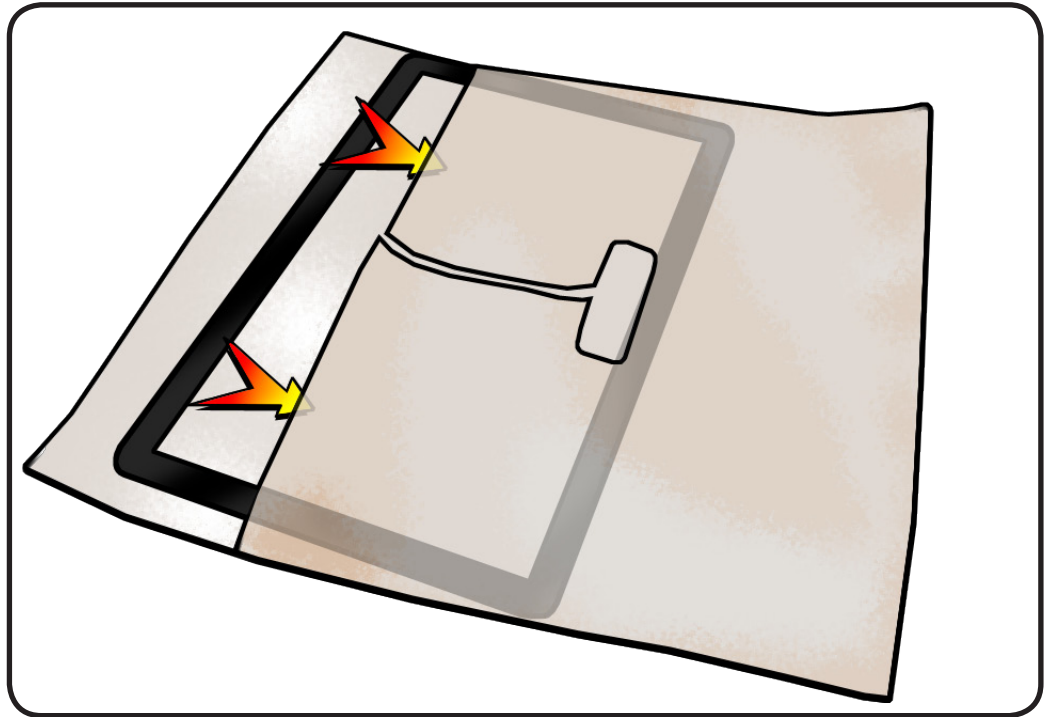
- 1** Glass panel can be removed in various ways:
 - Lay unit on its back and press clean suction cups in opposite corners on glass panel, or...
 - Lay unit on its back and press clean suction cups in top right and left corners on glass panel, or...
 - Stand unit upright and use fingernails to pull glass forward along top edge.



- 2** Lift panel up and off.



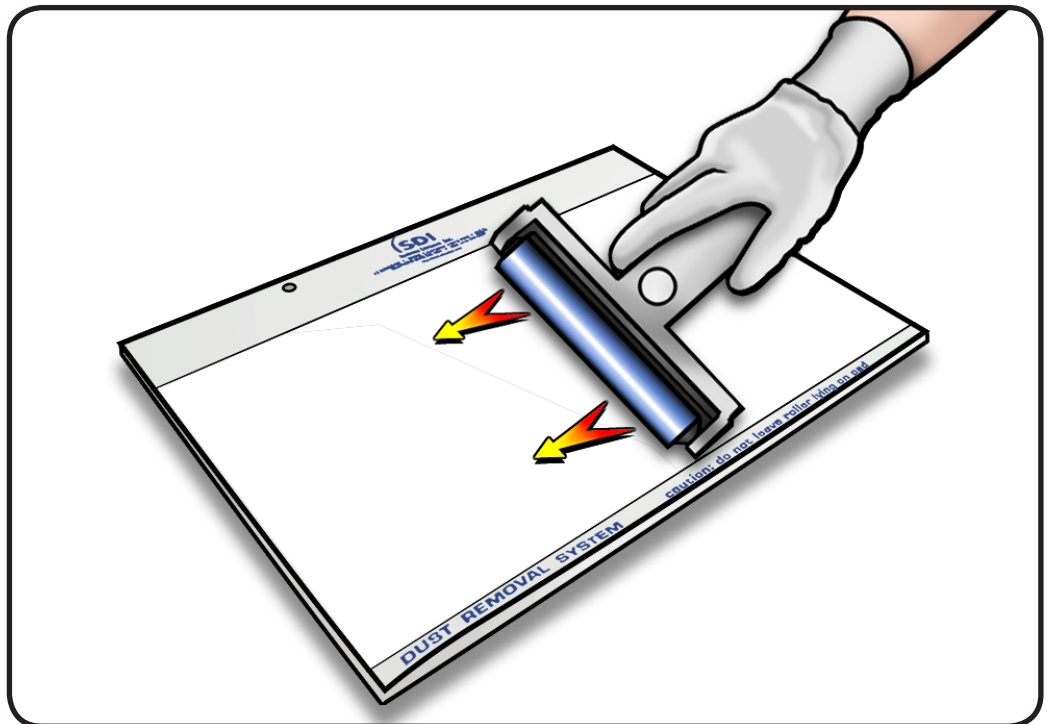
- 3 Remove suction cups and slide glass into protective microfoam bag.



Reassembly

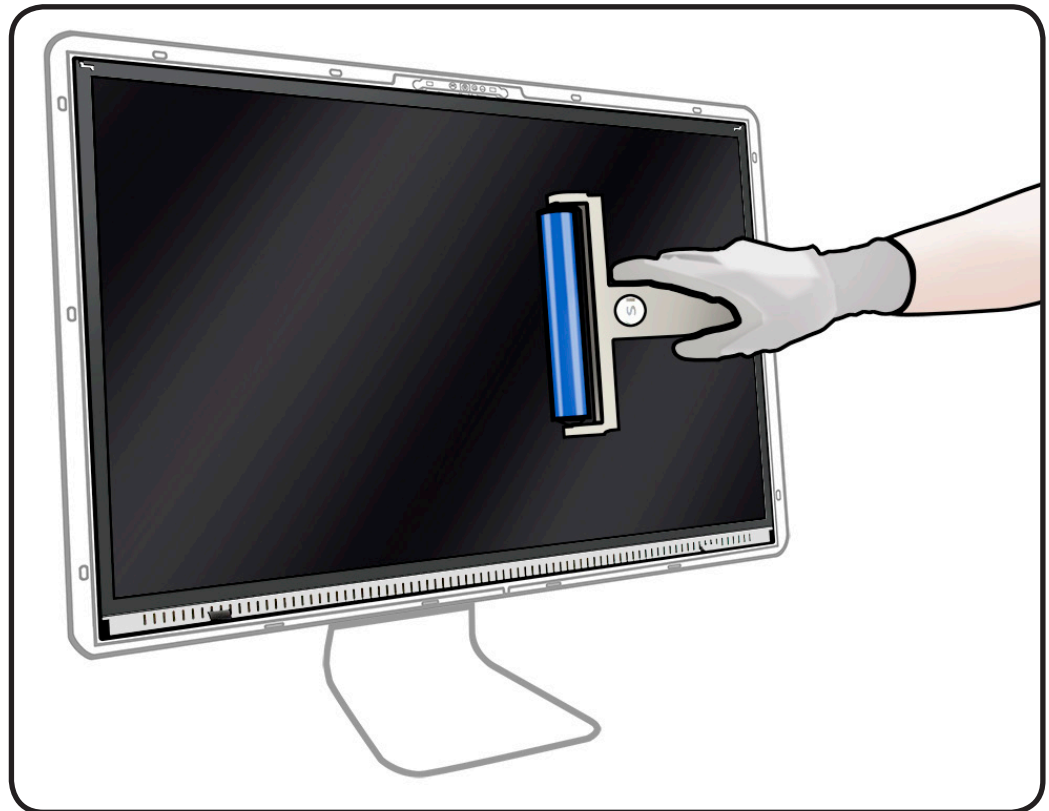
- 1 Remove protective covering from silicone roller and sticky sheet.
- 2 Clean silicone roller by rolling it back and forth a few times on sticky sheet.

If sticky sheet looks dirty, use a new one.
If roller is no longer tacky, wash it in warm soapy water.
If tackiness does not return, replace silicone roller.



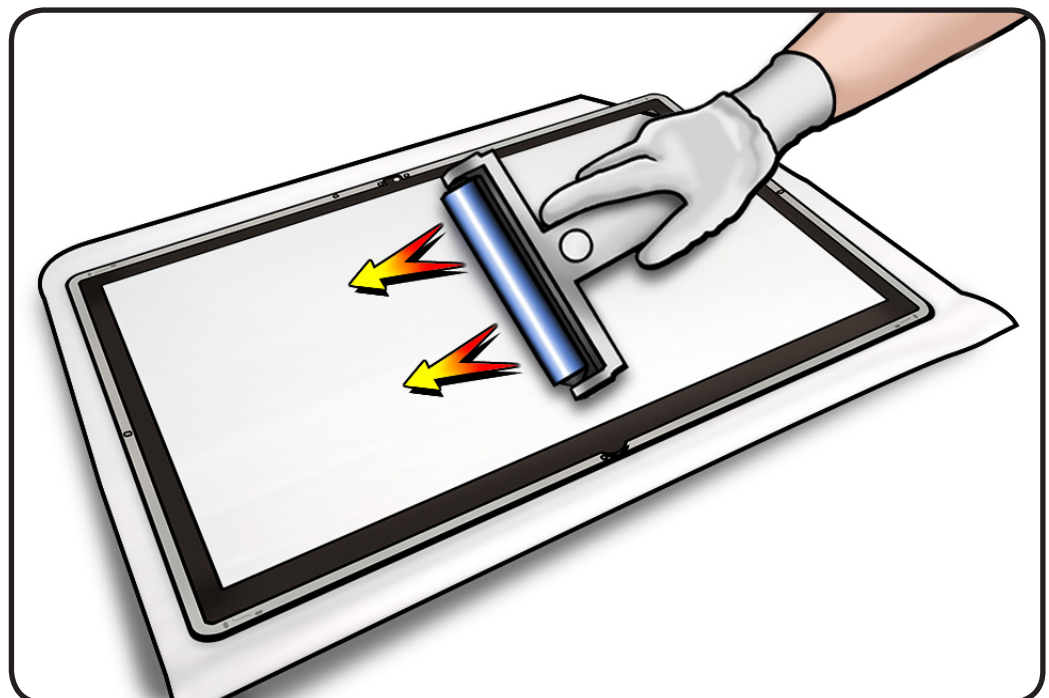


- 3 Set display in upright position to minimize settling of dust.
- 4 Roll silicone roller over LCD panel to remove any particles.



- 5 Remove glass panel from microfoam bag.
- 6 Clean INSIDE of glass panel with the silicone roller to remove dust.

Note: If fingerprints or oils are on inside of glass, clean first with a microfiber cloth made damp with water.



- 7** Wearing clean gloves, place glass directly onto display. Magnets will catch glass panel and hold it in place.

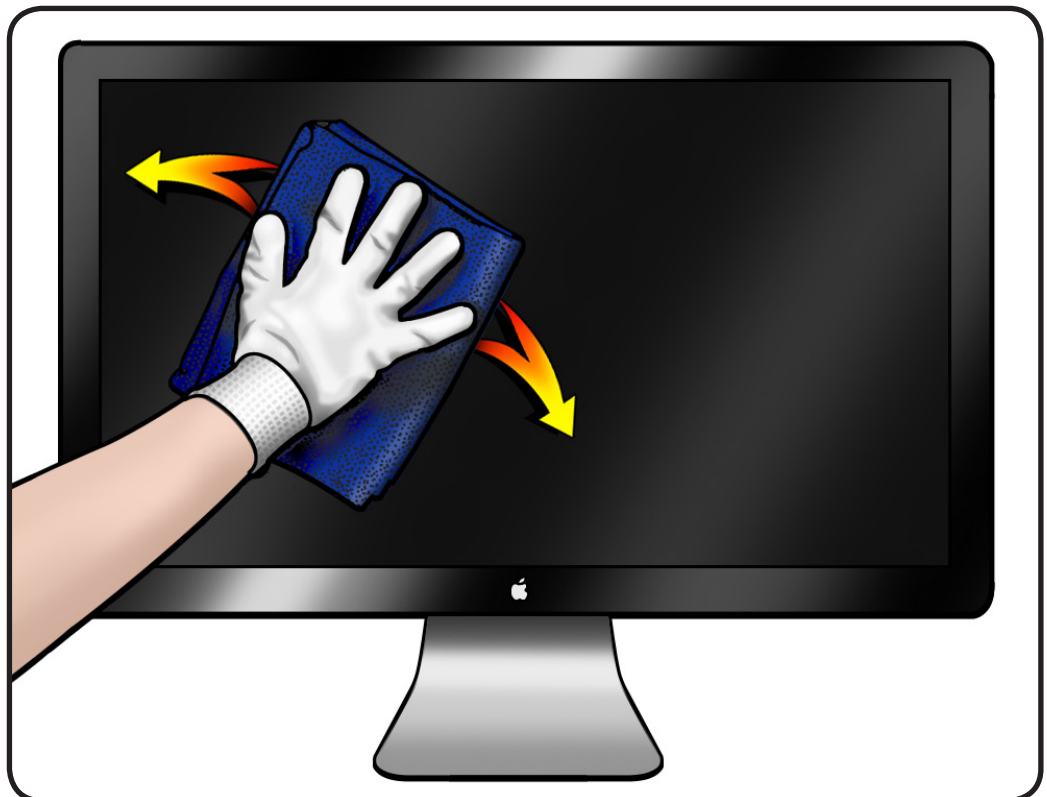
Make sure pull tabs at bottom of LCD panel are tucked behind glass panel.

Glass should be flush with rear housing after it is reinstalled.



- 8** Clean outside of glass panel with a clean microfiber cloth. Wipe glass until there is no longer any residue or haze.

- 9** Inspect glass for any remaining dust, fingerprints, or a hazy residue. If there are contaminants trapped between LCD panel and glass panel, repeat cleaning procedure.





LCD Panel

First Steps

- Unplug all cables and the power cord.
- Put on ESD strap.

Remove:

- [Glass Panel](#)

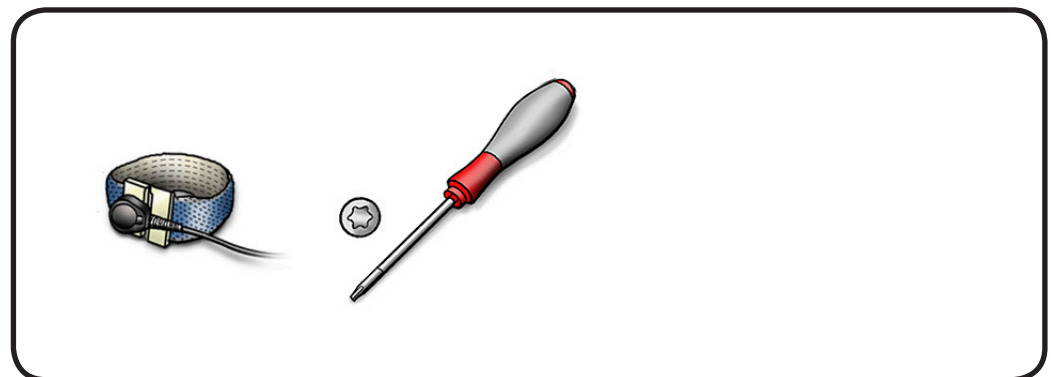


Caution: Do not press on front surface of LCD panel when handling.

Warning: HIGH VOLTAGE: Use extreme caution when working around the power supply (underneath the LCD panel), which contains a high-voltage capacitor that may remain charged for several minutes even when display is unplugged.

Tools

- ESD wrist strap
- Torx T10 screwdriver
- ESD bag to store LCD panel





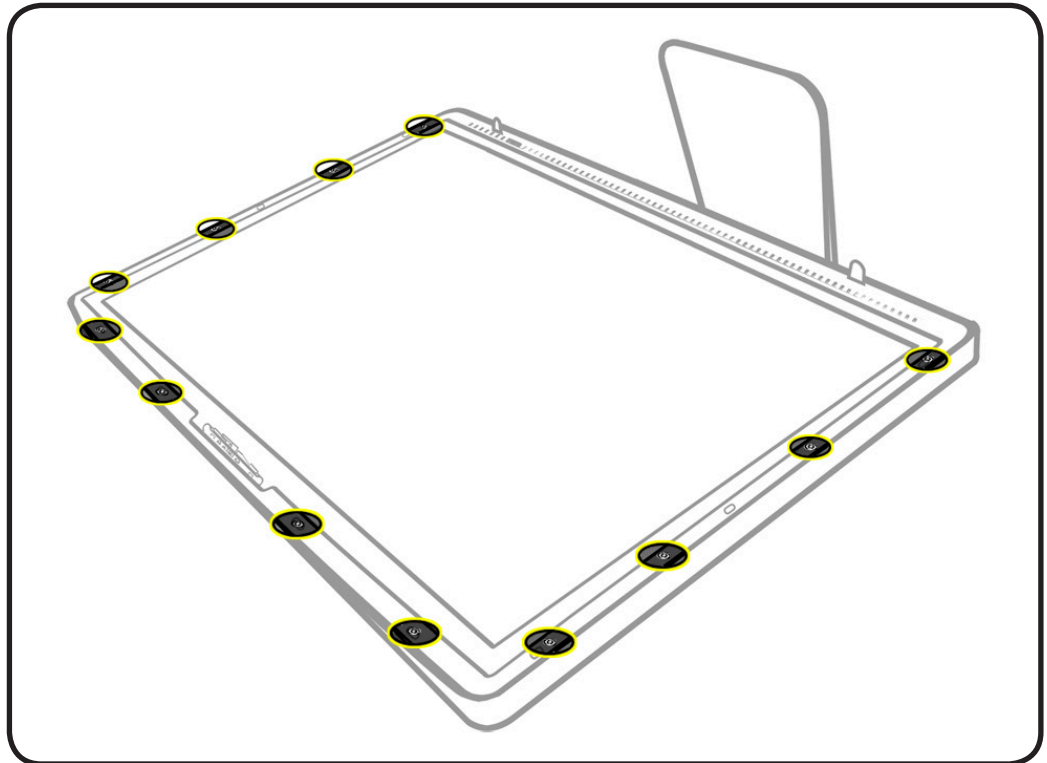
Removal

- 1 Remove T10 screws:
(12) 923-0006



Reassembly Note:

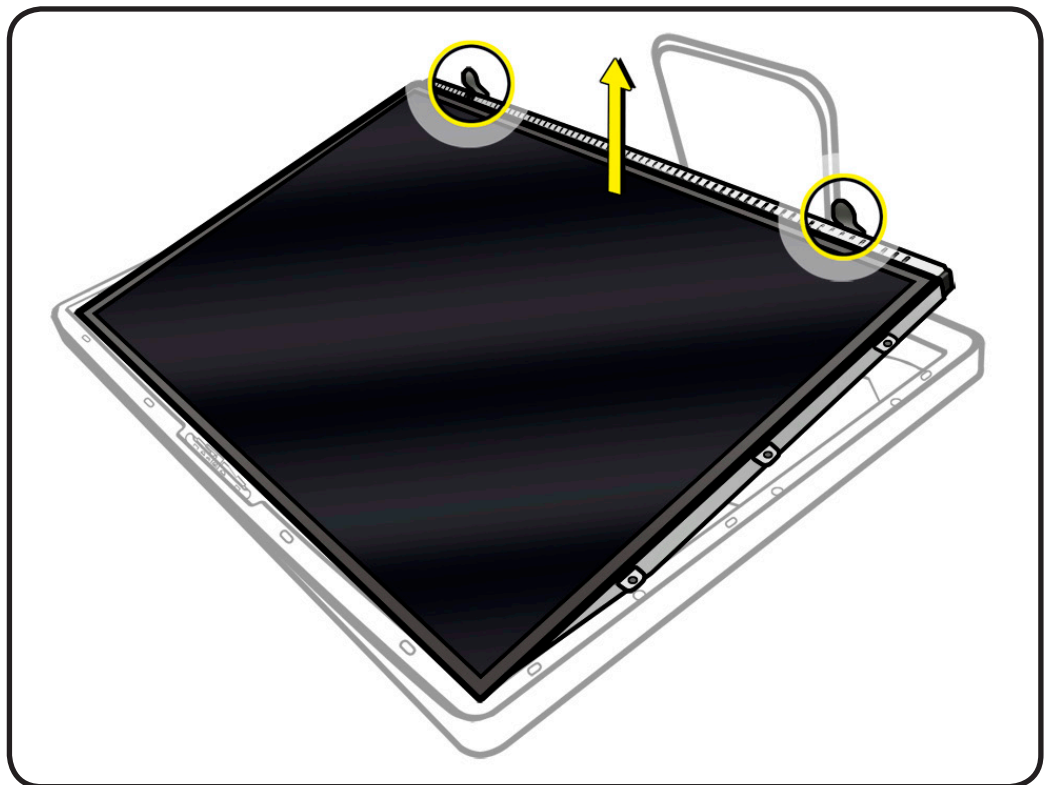
Do not overtighten LCD screws, which could cause light leakage after unit is reassembled.



- 2 Using black tabs, raise bottom edge of LCD a few inches to access cables inside.



CAUTION: Tilt display up **no more than 4 inches (10 cm)**. Pulling display too far could damage cables or connectors.



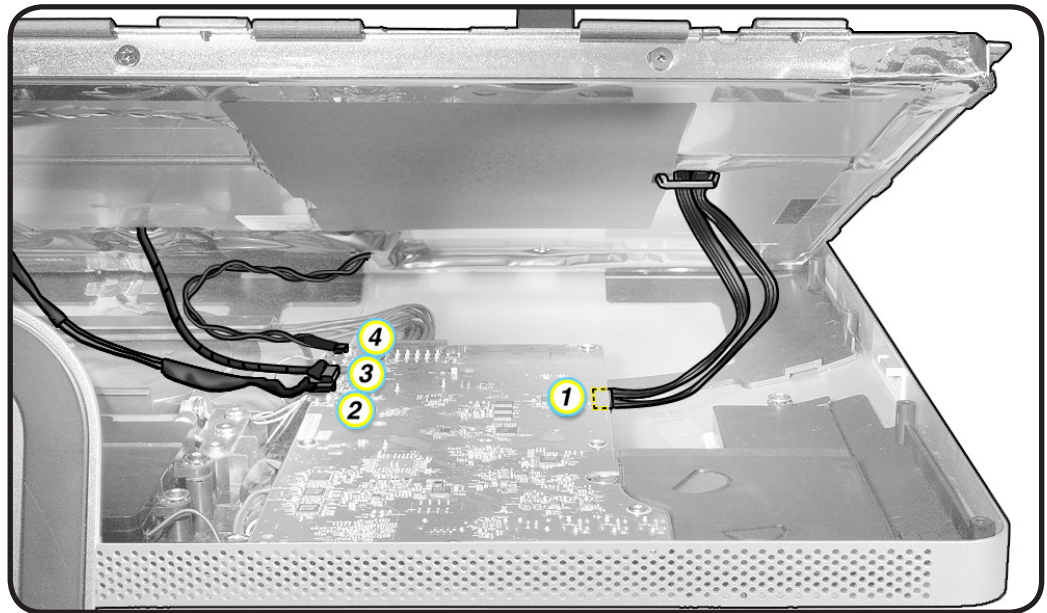


3 Looking into gap under LCD, disconnect 4 cables:

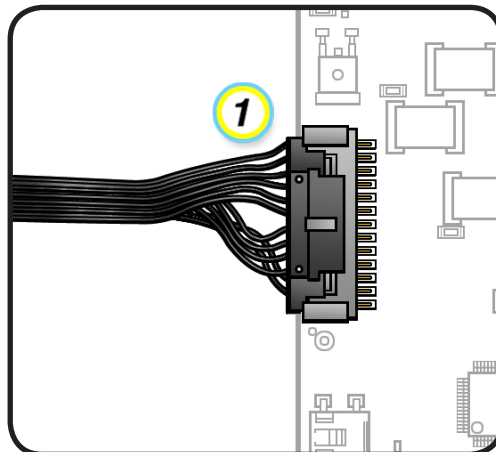
- #1: LED backlight driver
- #2: DisplayPort power
- #3: DisplayPort
- #4: ground

Reassembly Note:

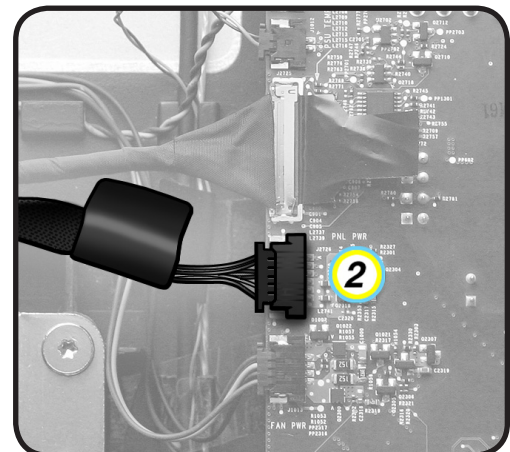
Verify that all cables are firmly seated into connectors. An unsecure cable connection can cause image flicker.



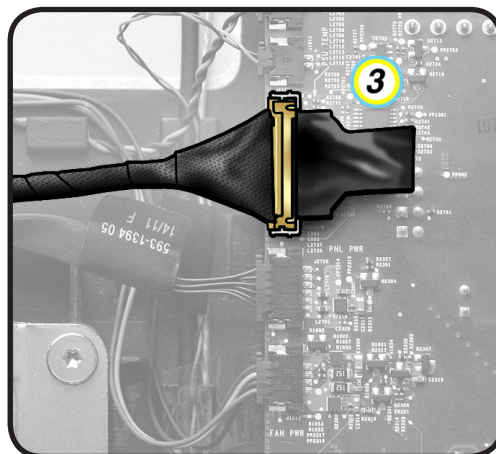
LEFT: Close-up of #1 LED backlight driver at center right of logic board (view from underneath board). Pinch underneath and pull straight out.



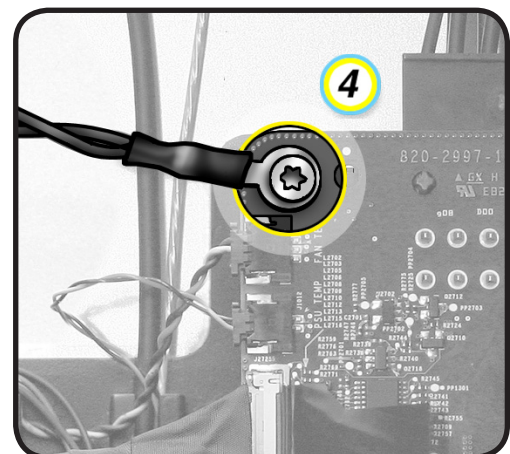
RIGHT: Close-up of #2 DisplayPort power cable at top left of logic board. Pull straight out.



LEFT: Close-up of #3 DisplayPort cable at top left of logic board. Flip up locking bar and then pull cable straight out of connector (see detail on next page).



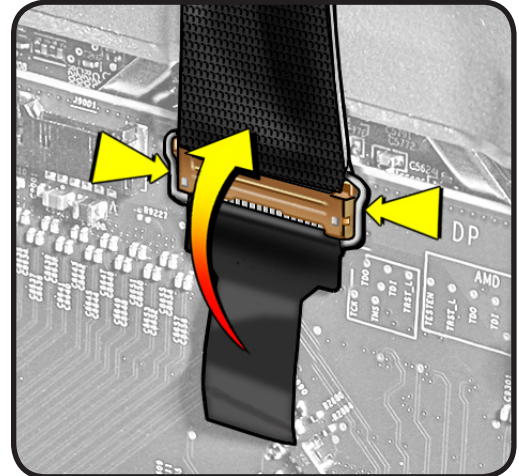
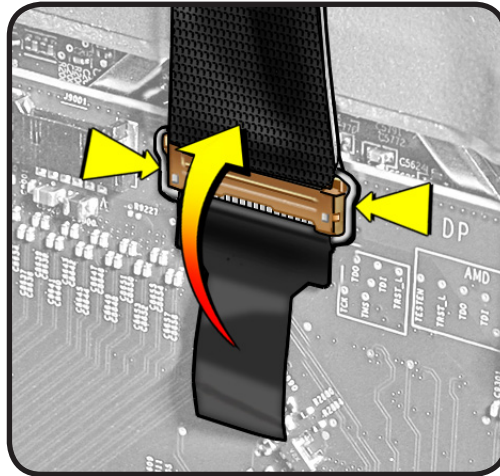
RIGHT: Close-up of #4 ground cable at top left of logic board. Remove T10 screw from top left corner of logic board.





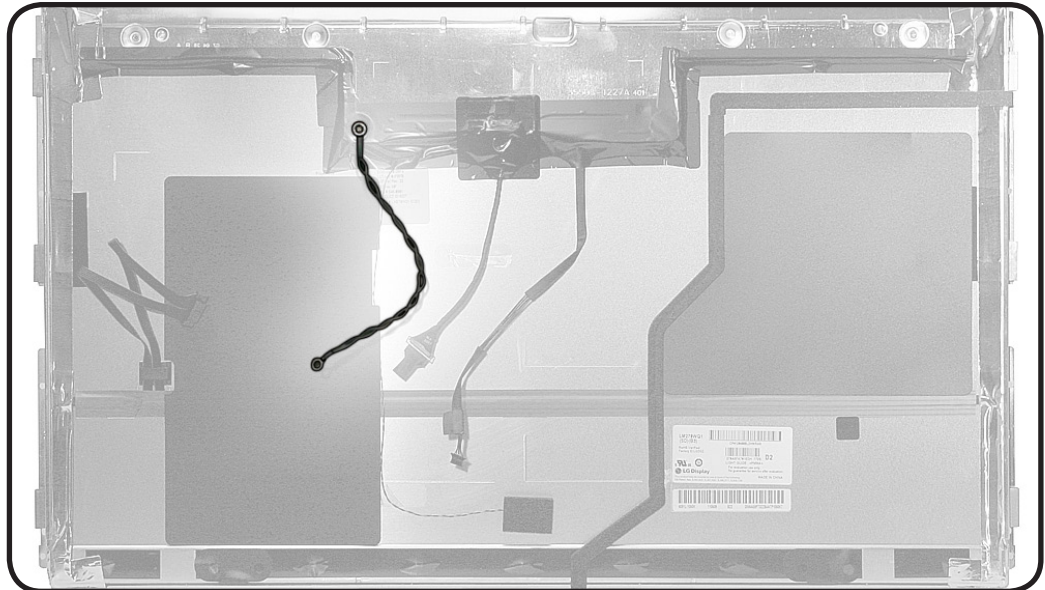
Detail of DisplayPort Connector

This is a thin, multi-pin horizontal insert connector like those used in portable computers. Close-ups show DisplayPort cable removal and locking bar.



Replacement Note:

A new LCD panel includes all cables except the ground cable (shown at right), which must be transferred.



4 Lift LCD panel off rear housing.

5 To prevent buildup of static charges which may attract dust particles to the surface of the LCD, store LCD panel in an anti-static bag whenever it has been removed from display.

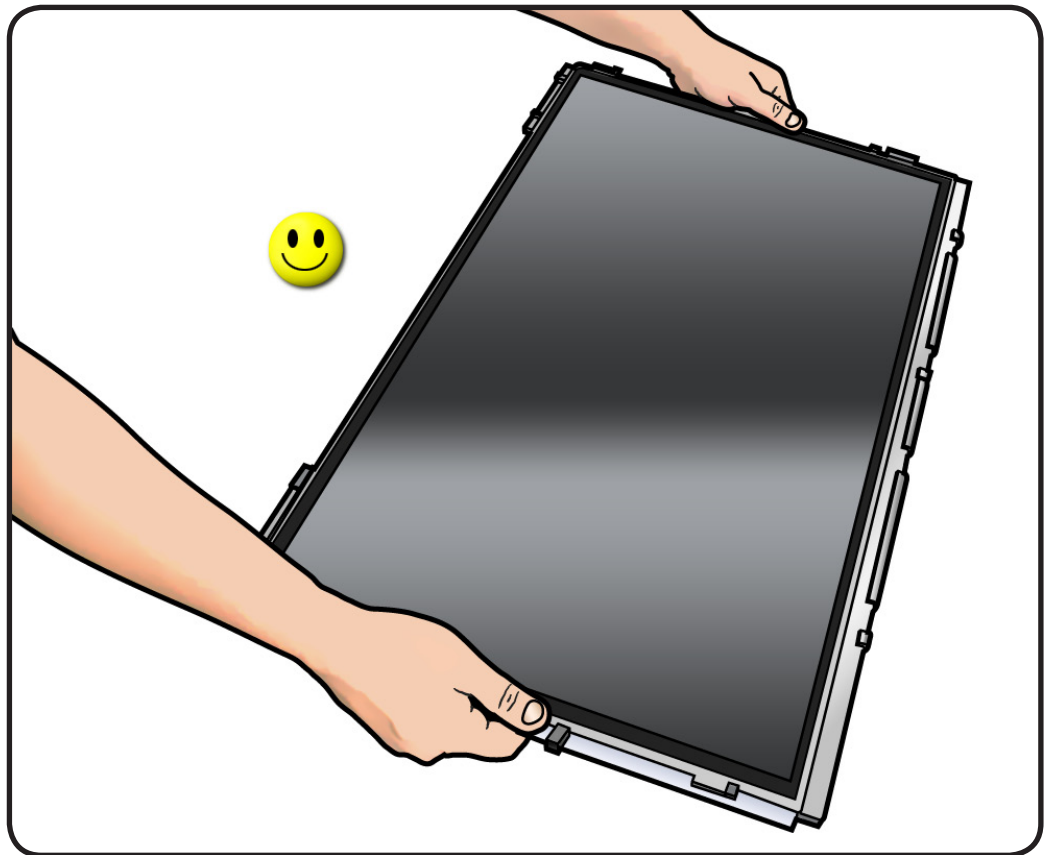




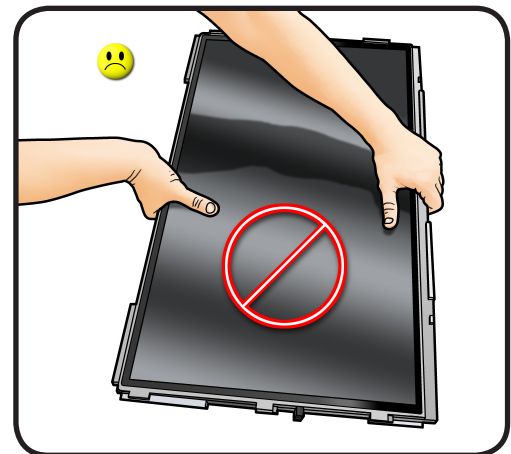
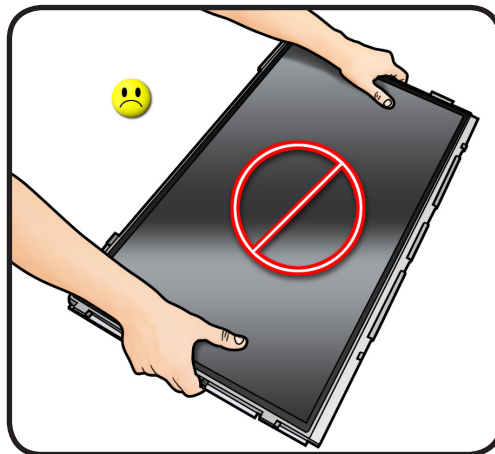
Handling LCD Panel

- 1 Important:** Handle LCD panel by edges only.

Use two hands to carry the panel.



- 2** Never touch LCD surface or hold LCD panel with one hand. It could damage the LCD panel.





DisplayPort Cable

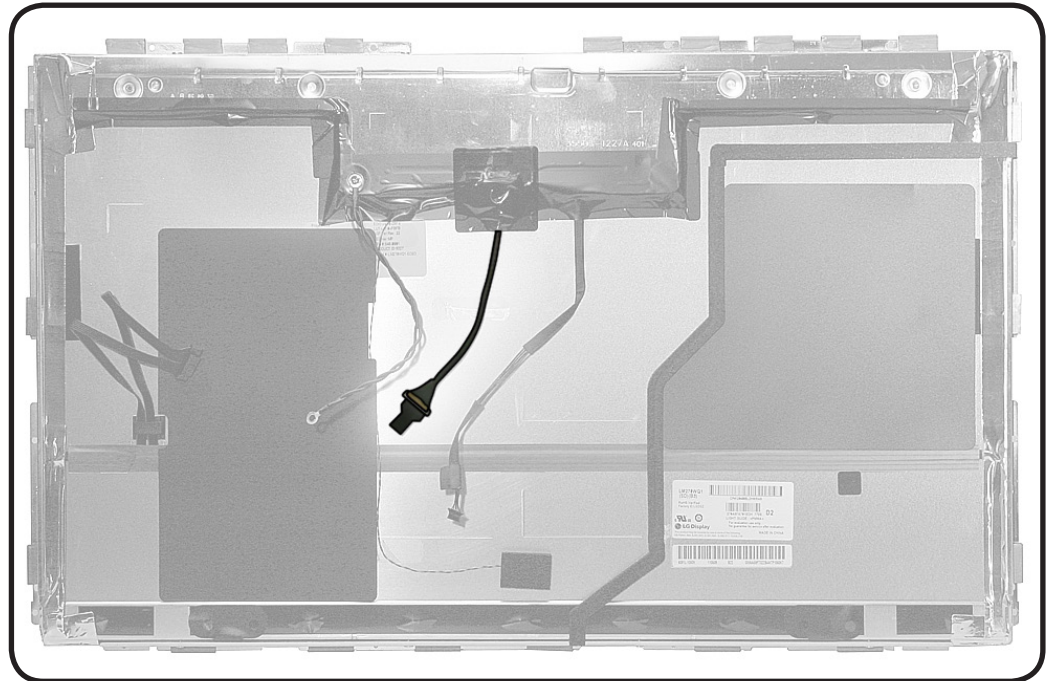
First Steps

Remove:

- [Glass Panel](#)
- [LCD Panel](#)

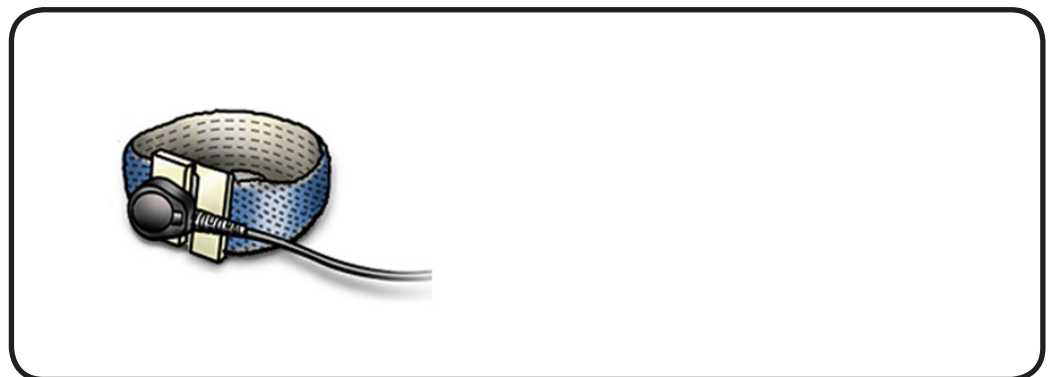
Note: A new DisplayPort cable includes new mylar and foil tape.

Note: A new LCD panel includes a new DisplayPort cable pre-installed.



Tools

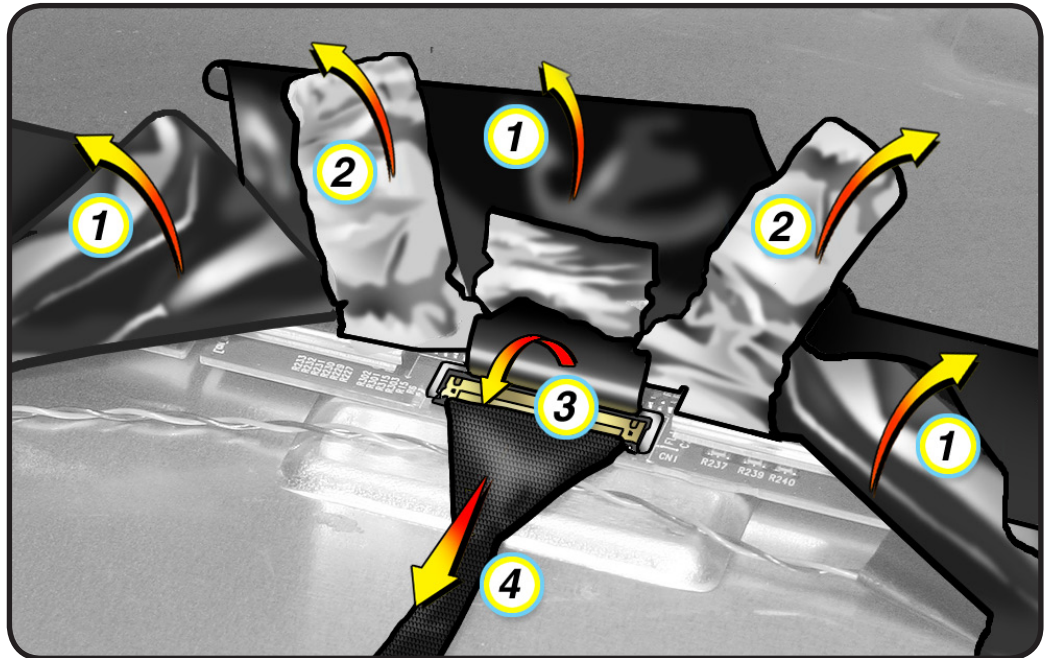
- ESD wrist strap





Removal

- 1 Note cable routing and placement of tape securing cable to LCD panel.
- 2 Peel back black mylar and foil strips covering connector.
- 3 Flip up locking bar and then pull cable straight out of connector to remove from LCD panel.

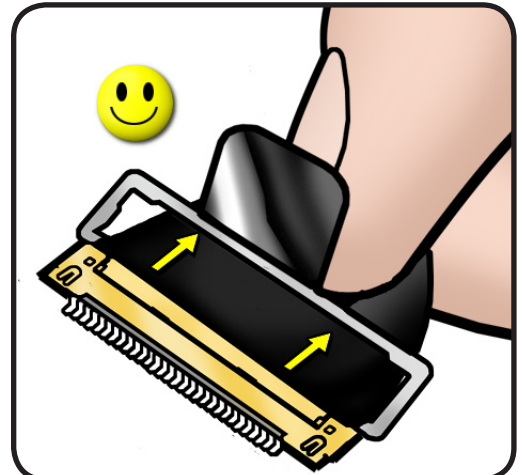
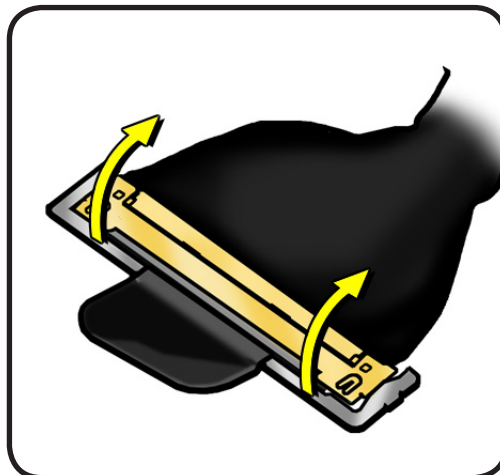


Reassembly Note:

Insert cable securely into connector and replace all mylar and foil tape completely and securely.

Detail of DisplayPort Connector

This is a thin, multi-pin horizontal insert connector like those used in portable computers.





DisplayPort Power Cable

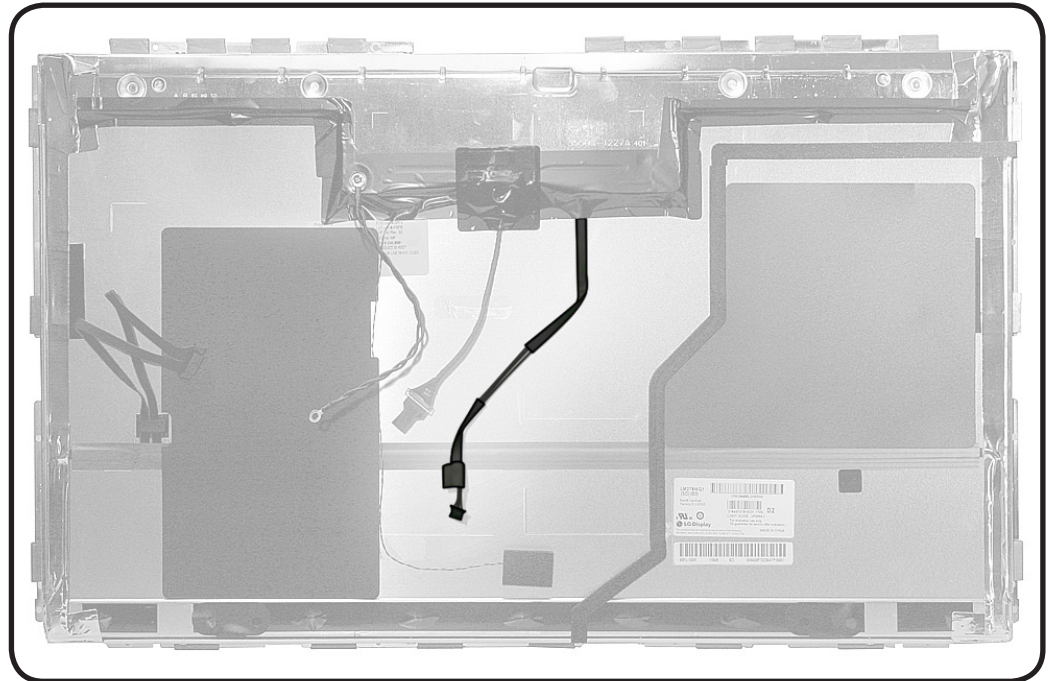
First Steps

Remove:

- [Glass Panel](#)
- [LCD Panel](#)

Note: A new DisplayPort power cable includes new mylar and foil tape.

Note: A new LCD panel includes a new DisplayPort power cable pre-installed.



Tools

- ESD wrist strap



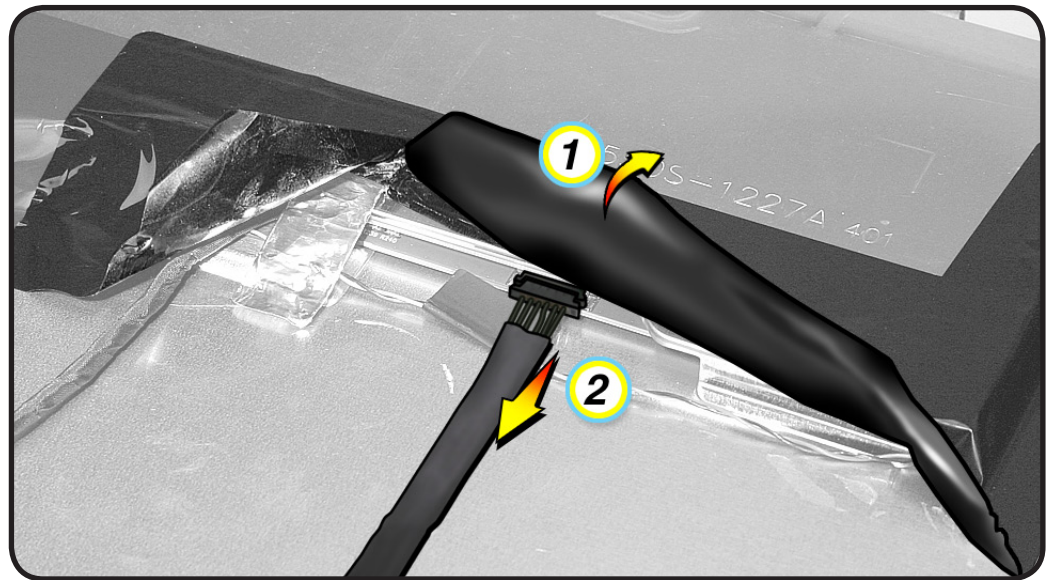


Removal

- 1 Note cable routing and placement of tape securing cable to LCD panel.
- 2 Peel back black mylar covering connector.
- 3 Pull cable straight out to remove from LCD panel.

Reassembly Note:

Insert cable securely into connector and replace all mylar tape completely and securely.





LCD Sensor Cable

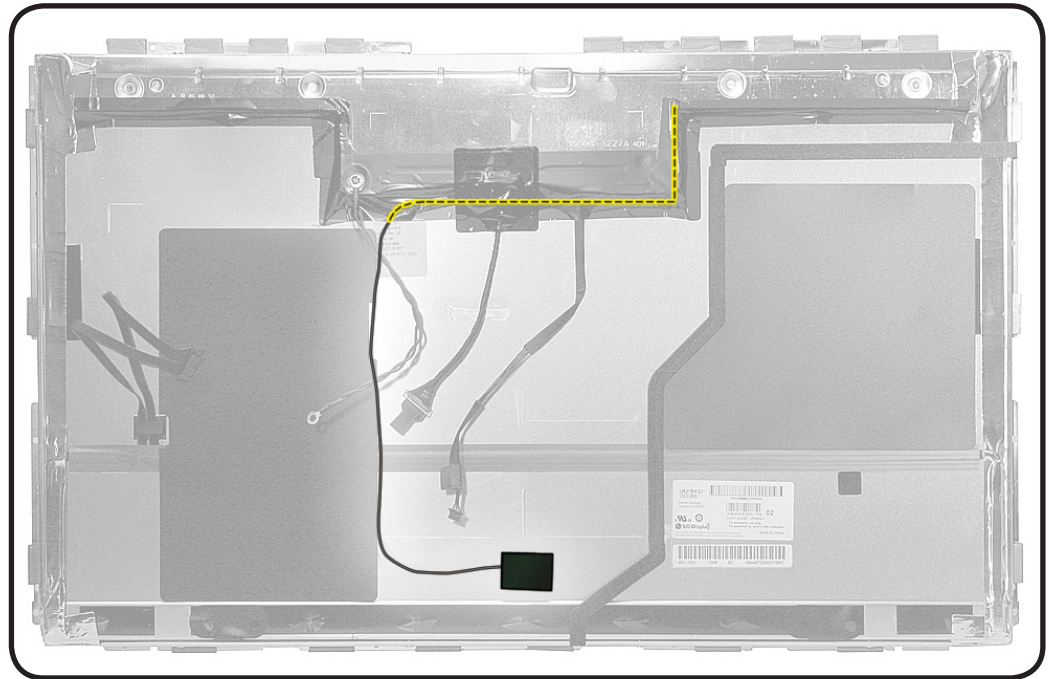
First Steps

Remove:

- [Glass Panel](#)
- [LCD Panel](#)

Note: A new LCD sensor cable includes new mylar and foil tape, and a new foam gasket.

Note: A new LCD panel includes a new sensor cable pre-installed.



Tools

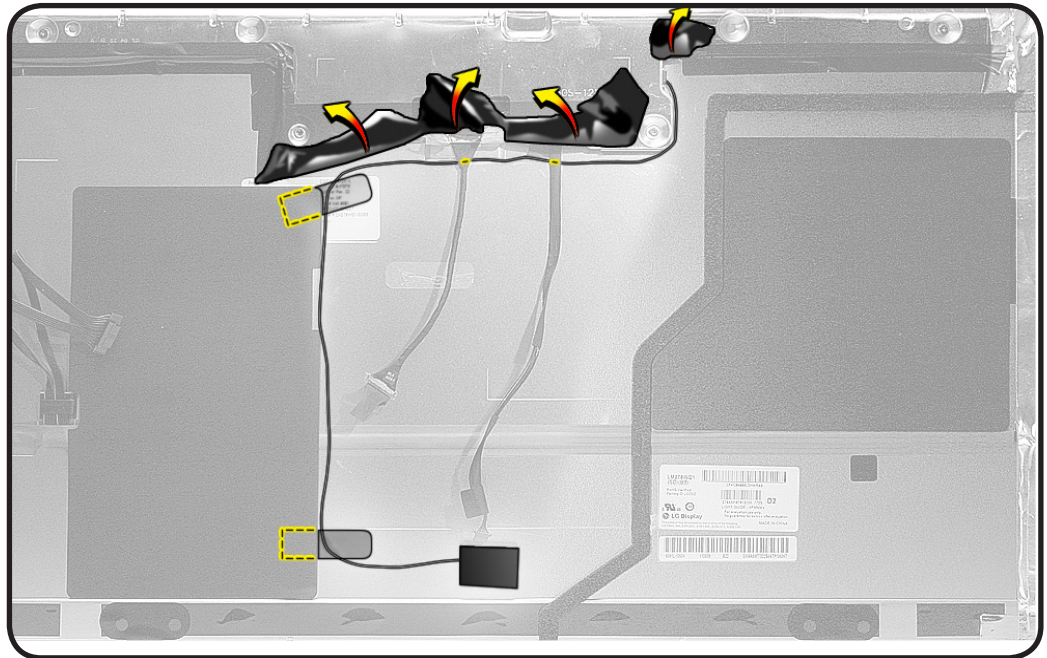
- ESD wrist strap





Removal

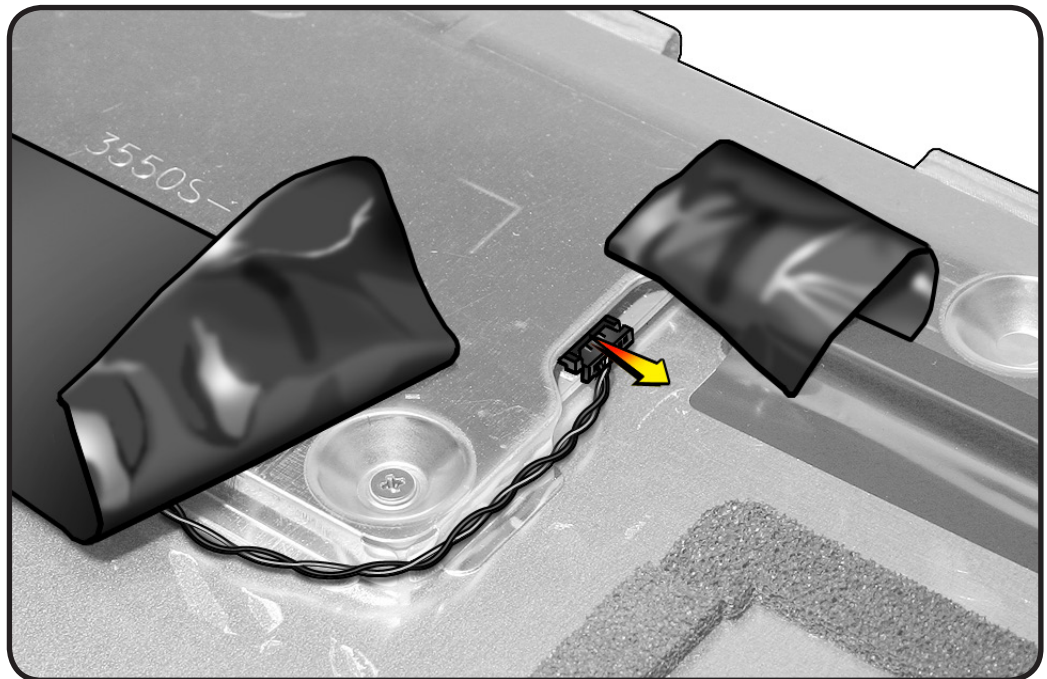
- 1 Peel back mylar at top rear of LCD panel.
- 2 Note cable routing and placement of tape securing cable to LCD panel.



- 3 Pull cable straight out of connector at top rear of LCD panel.

Reassembly Note:

Insert cable securely into connector and replace all mylar and foil tape completely and securely.



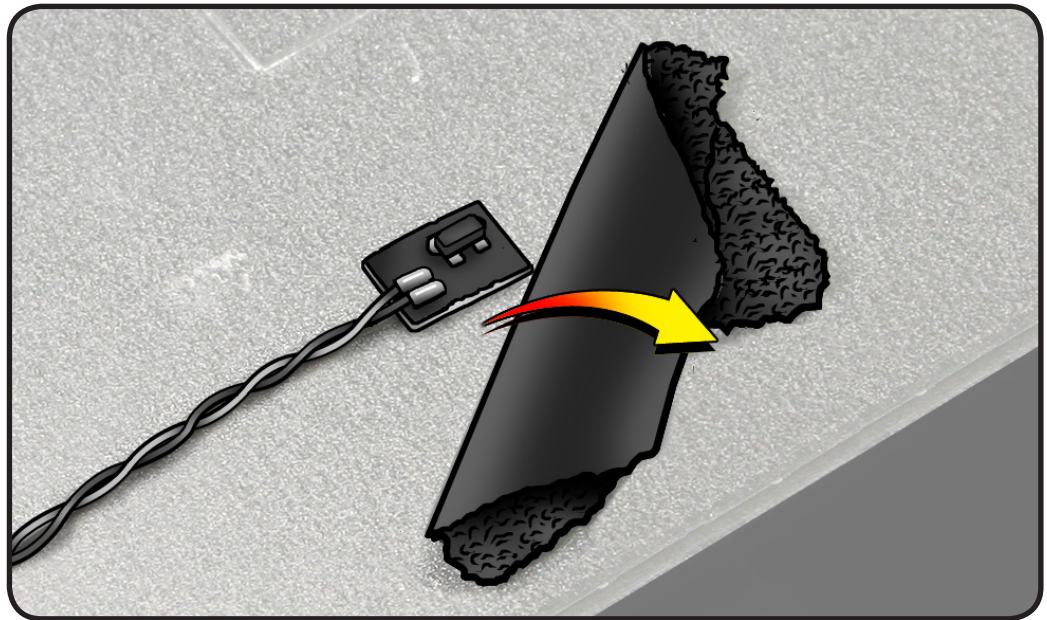


- 4 Peel back foam gasket covering sensor at bottom rear of LCD panel.

Replacement Note:

Fully cover sensor with gasket to isolate from internal air temperature.

- 5 Remove cable from LCD panel.





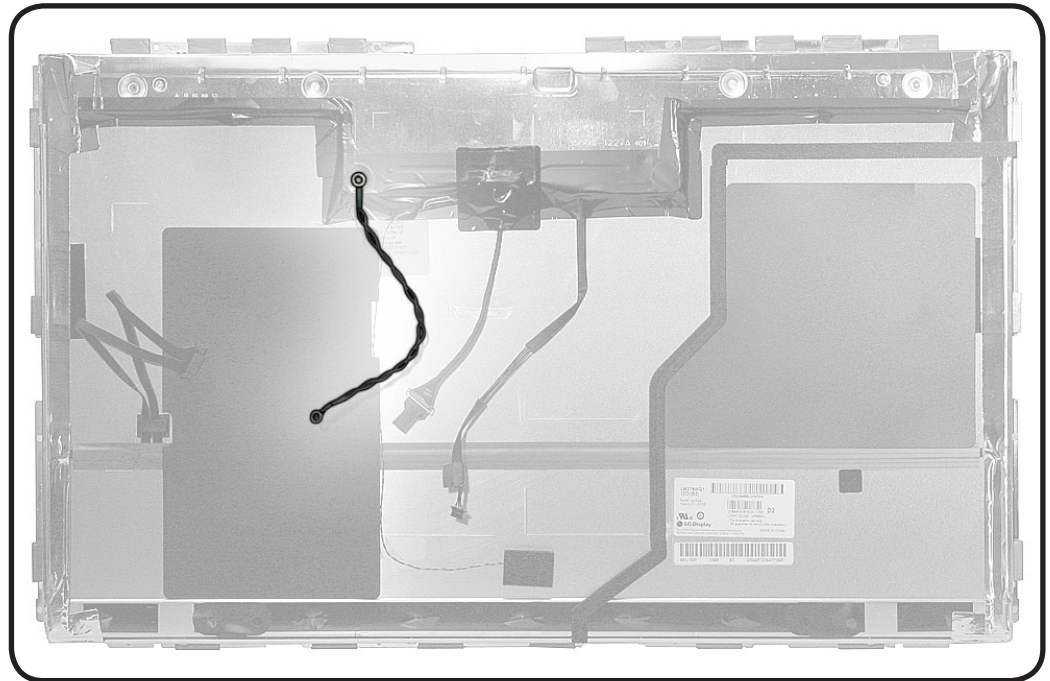
LCD Ground Cable

First Steps

Remove:

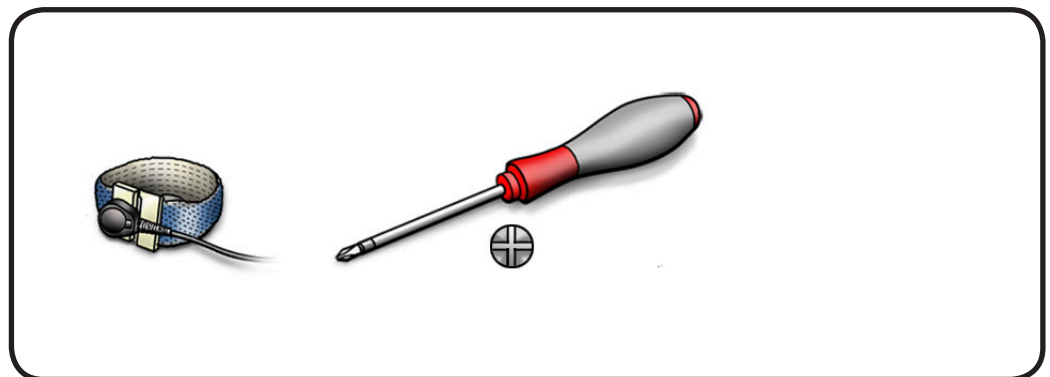
- [Glass Panel](#)
- [LCD Panel](#)

Note: A new LCD panel does not include a new ground cable; it must be transferred from old LCD panel.



Tools

- ESD wrist strap
- Phillips #0 screwdriver



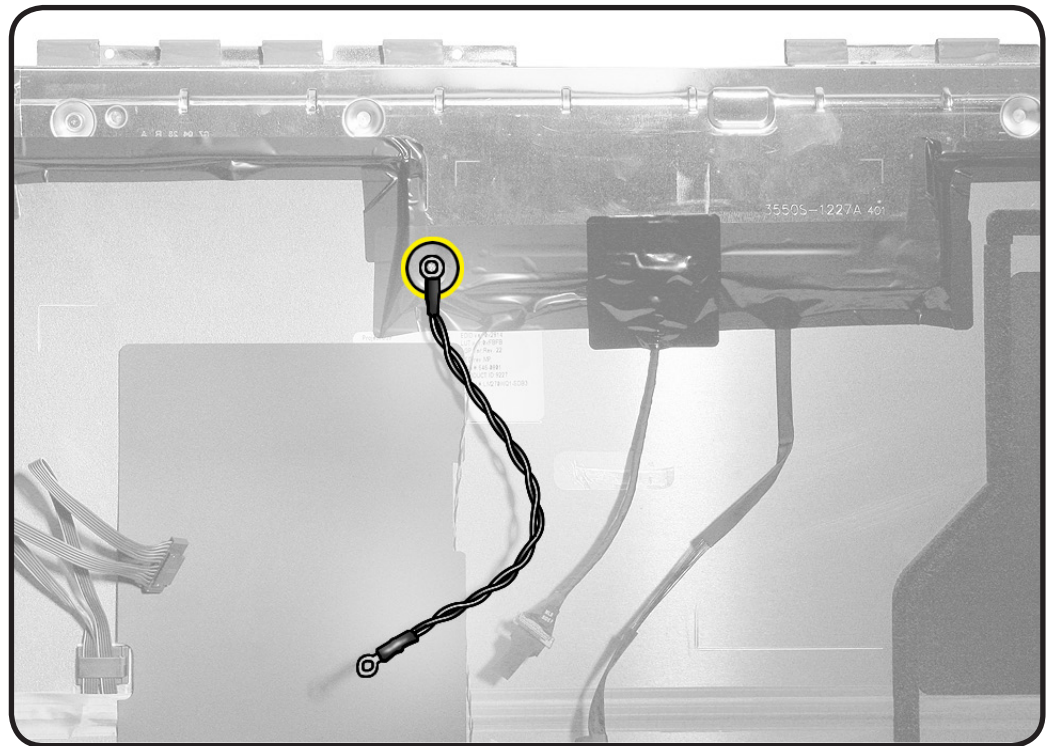


Removal

- 1 Remove Phillips #0 screw:
(1) 922-9724



- 2 Remove cable from LCD panel.





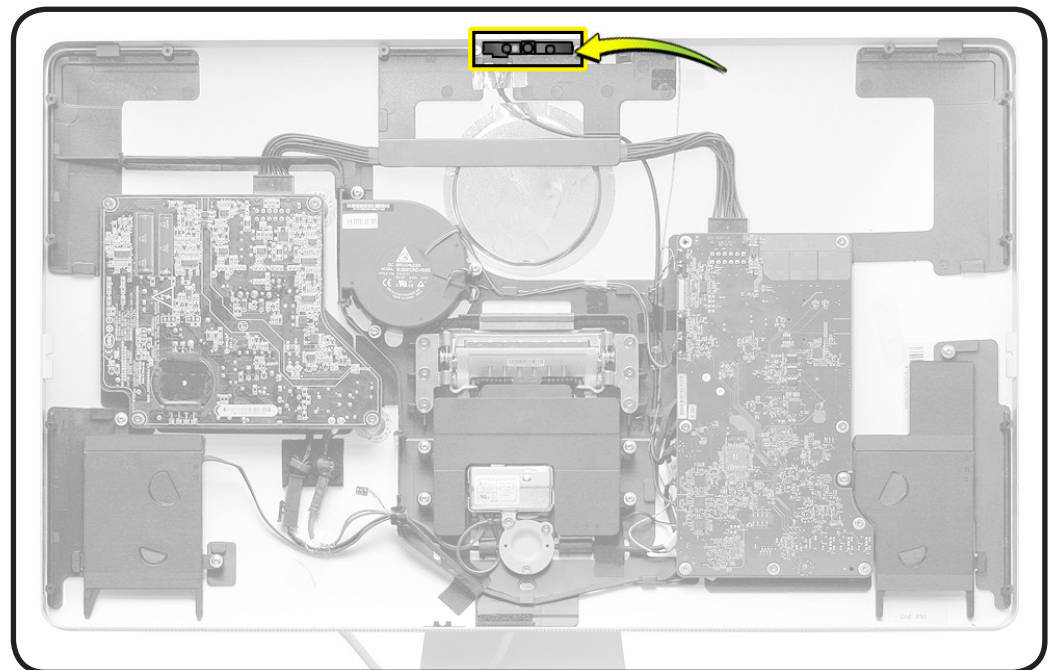
Camera

First Steps

Remove:

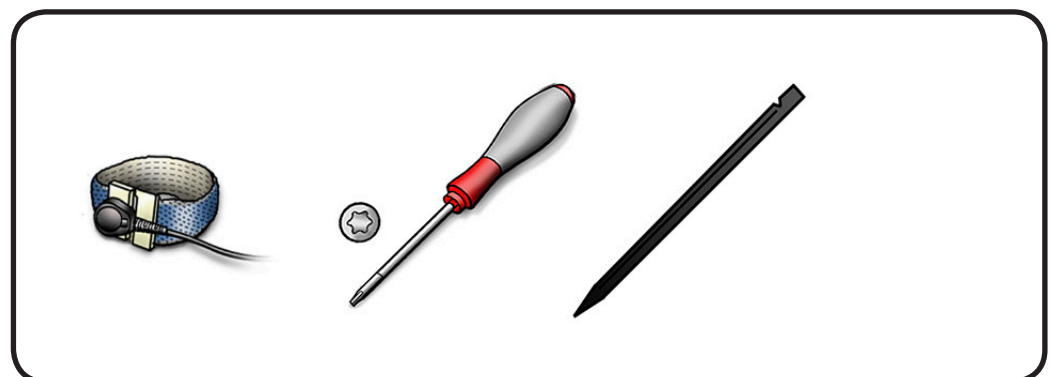
- [Glass Panel](#)
- [LCD Panel](#)

Important: The camera assembly contains an ambient light sensor. When replacing camera, use the [EEPROM Reset Tool](#) to reset the ambient light sensor's calibration factor.



Tools

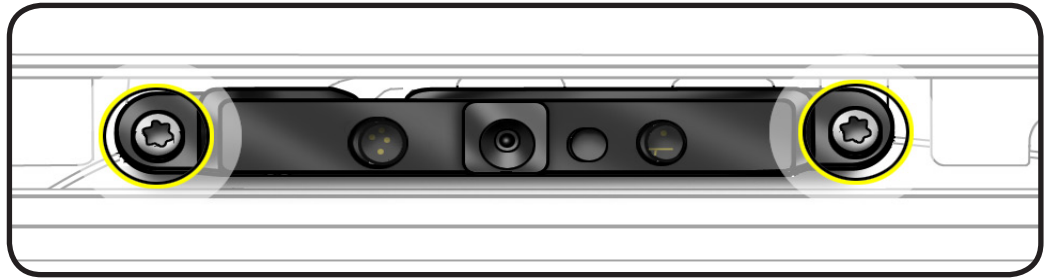
- ESD wrist strap
- Torx T10 screwdriver
- Black stick





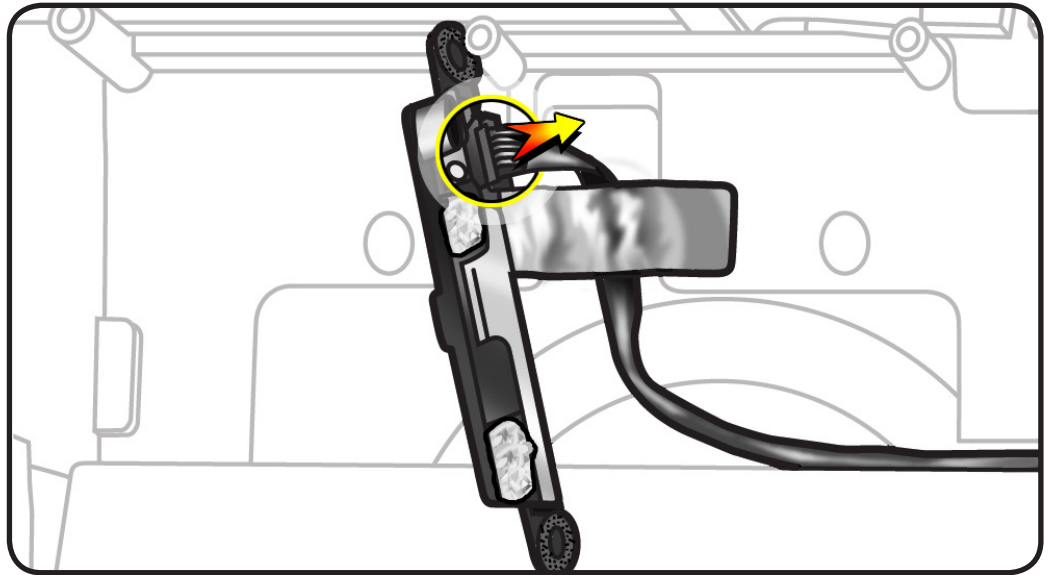
Removal

- 1 Remove T10 screws:
(2) 922-9723



- 2 Lift camera out of rear housing.

- 3 Disconnect cable from camera.



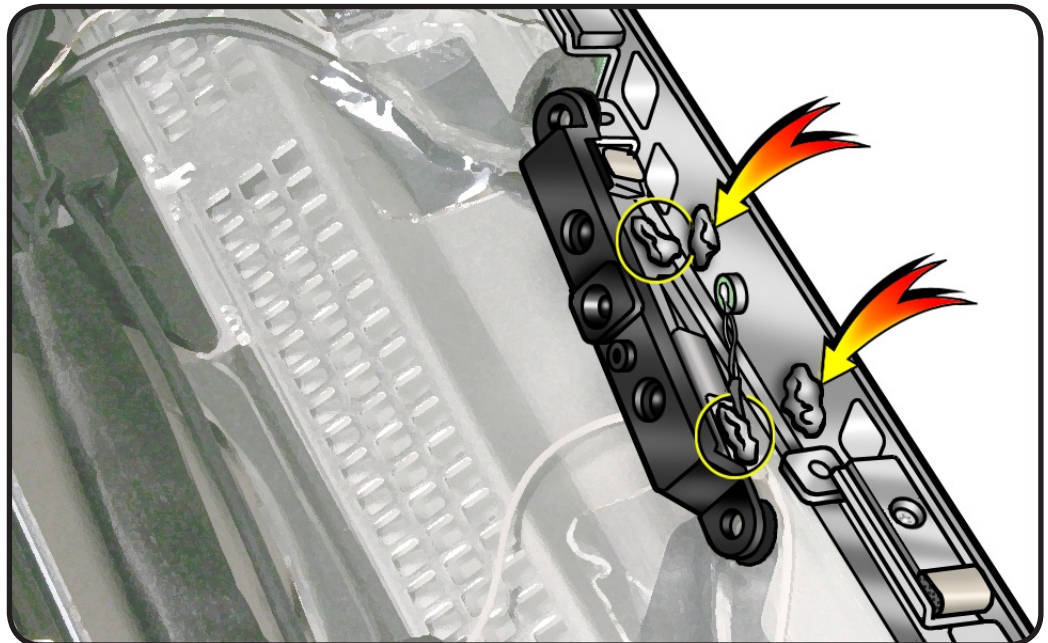
Reassembly

- 1 Thermal material is required between camera and rear housing. Reuse the thermal material.

- 2 Use a black stick to remove and reapply thermal material to camera (areas circled).

Note: A syringe of thermal material is available as needed, Apple part# 922- 9625, good for 5 applications.

Important: The white thermal material used on camera should NOT be used for any other purpose (such as portable computer heat sinks.)



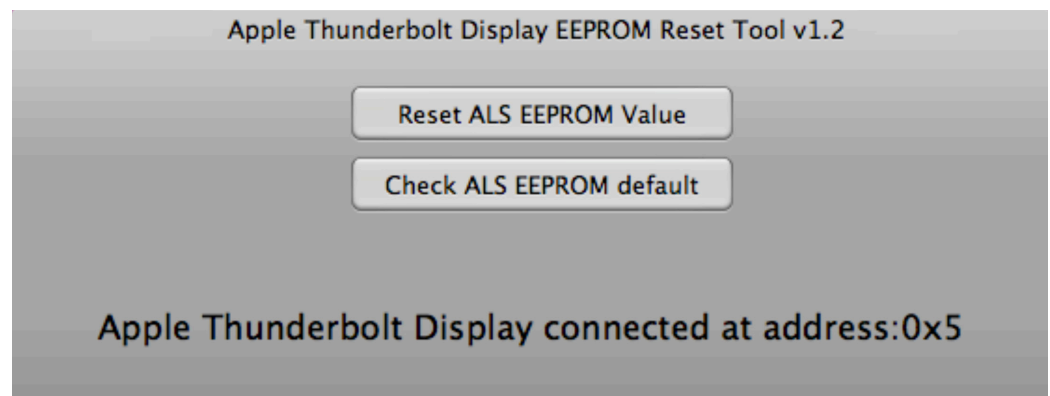


EEPROM Reset Tool

After replacing the camera in an Thunderbolt Display (27-inch), run the EEPROM Reset Tool to reset the Ambient Light Sensor (ALS) calibration factor.

Important: This tool should only be run when the camera has been replaced.

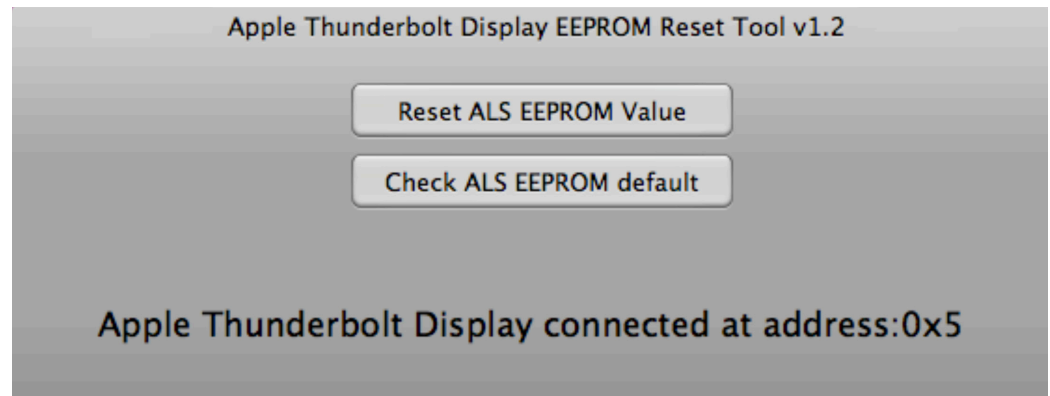
1. [Download the EEPROM Reset Tool](#) from GSX by navigating to Resources, then selecting both “Displays” and “Service Disk Image.”
2. Launch the EEPROM Reset Tool on a Thunderbolt-capable host computer that is connected to the Thunderbolt Display (27-inch) under test. The following window will appear:



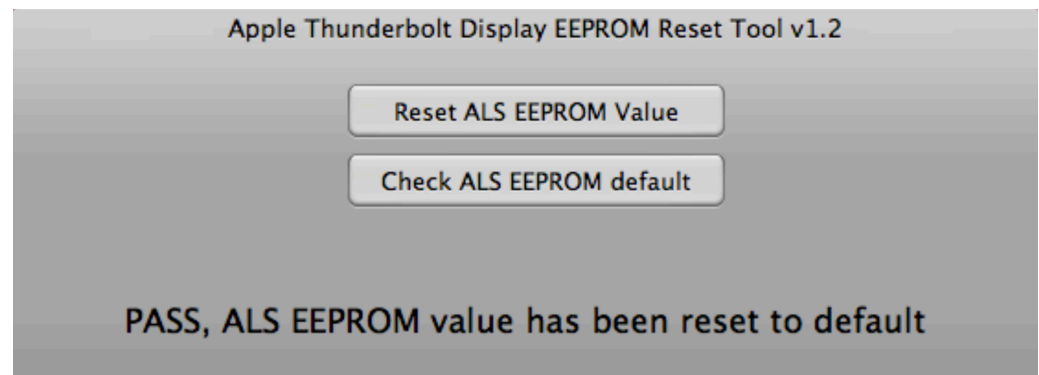
3. Select the “Reset ALS EEPROM Value” button. A dialog box will ask if the camera has been replaced.
Note: The EEPROM should only be reset after the camera has been replaced. If the camera has not been replaced, choose “No” and do not reset the EEPROM.



4. If the camera has been replaced, choose “Yes.” The EEPROM calibration factor will be reset. The display’s screen will go black for a few moments and then will return to the first window above.



5. Select the “Check ALS EEPROM default” button. The response should be:



6. The reset process is now complete.



Camera Cable

First Steps

Remove:

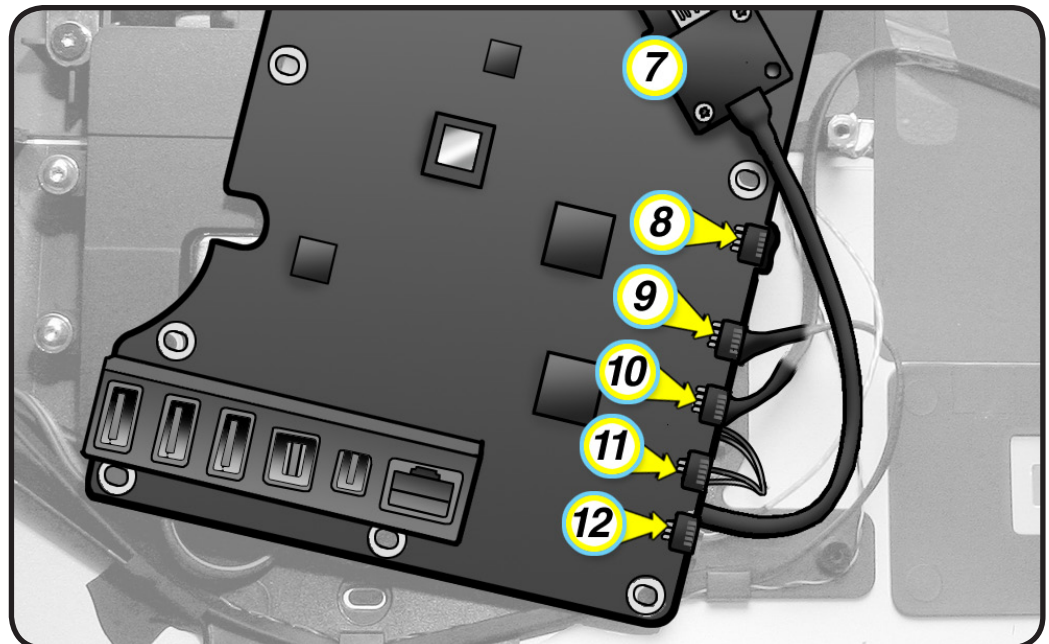
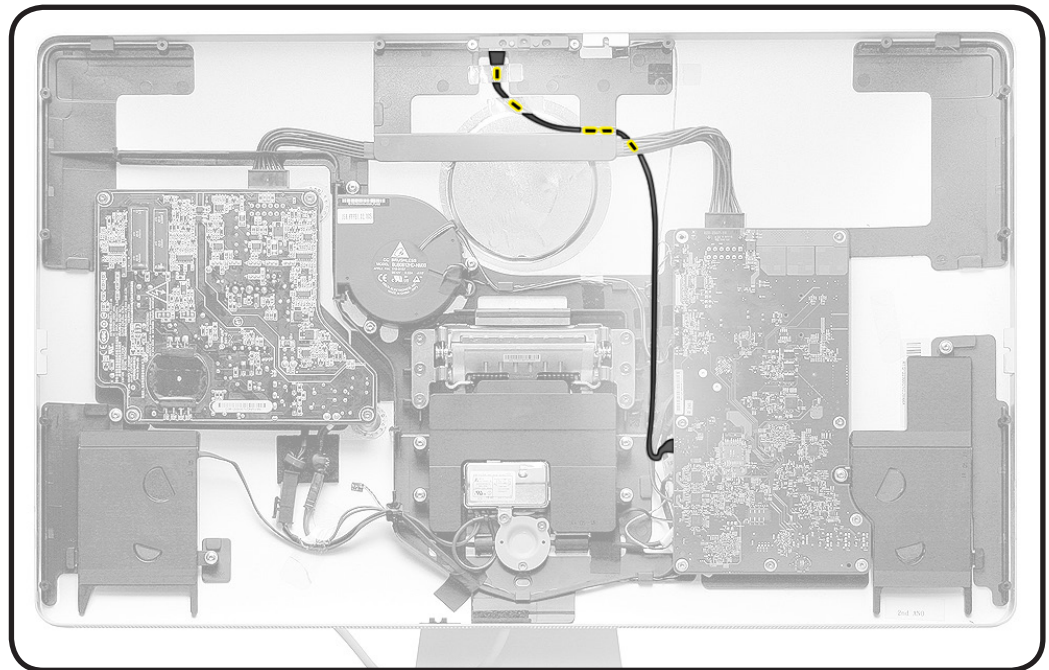
- [Glass Panel](#)
- [LCD Panel](#)
- [Camera](#)

Removal

- 1 Note cable routing through black plastic guides in rear housing, and tape securing camera cable to rear housing.
- 2 Disconnect cable from camera and from logic board.

Reassembly Note:

For easier access to reconnect camera cable (8), unscrew and flip over logic board.





Power Supply

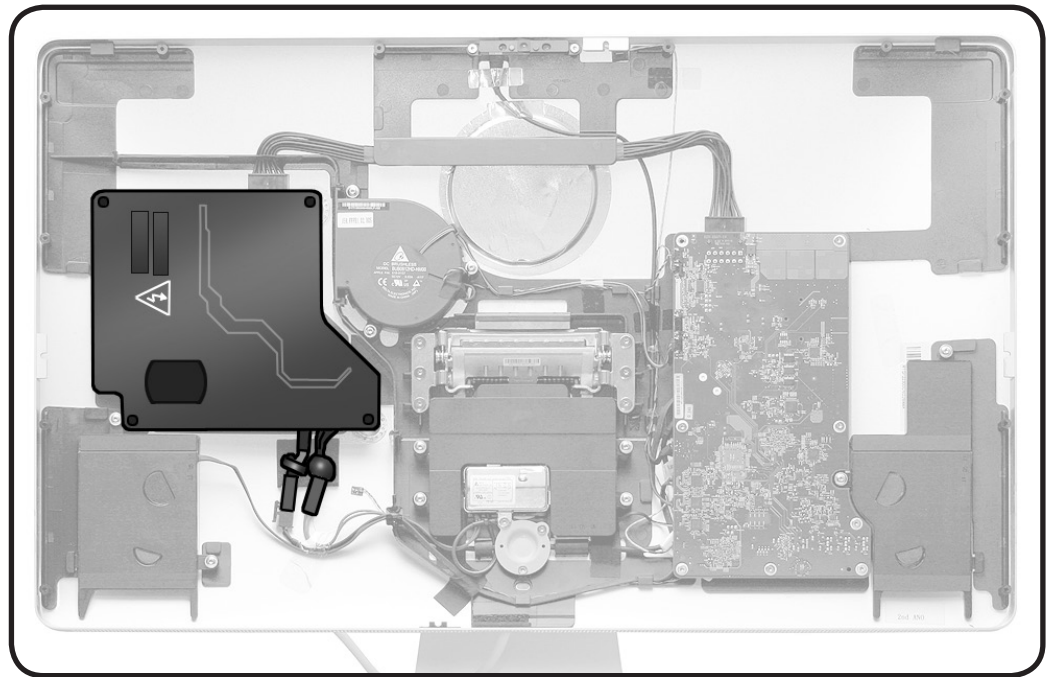
First Steps

Remove:

- [Glass Panel](#)
- [LCD Panel](#)

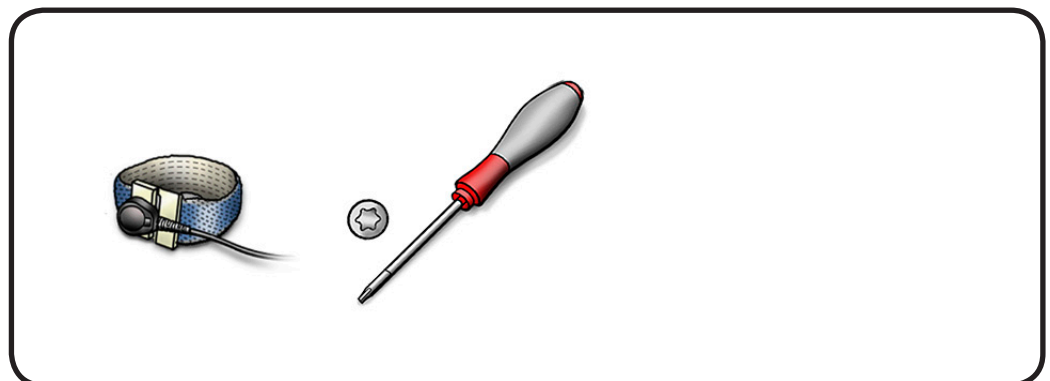


Important: Wait one (1) hour after unplugging the computer from the electrical outlet before removing the power supply or working near the power supply leads. The power supply contains a high voltage capacitor that may remain charged for up to an hour after unplugging the computer.



Tools

- ESD wrist strap
- Torx T10 screwdriver





Removal

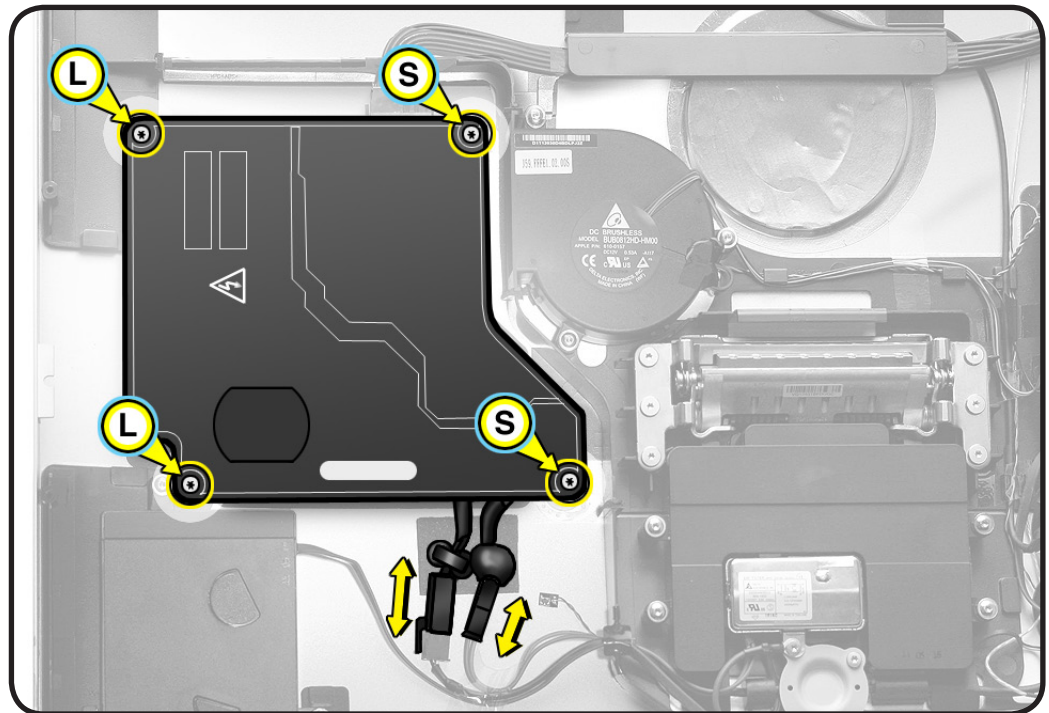
- 1 Remove T10 screws:
(2) 923-0006, long (L),
at left



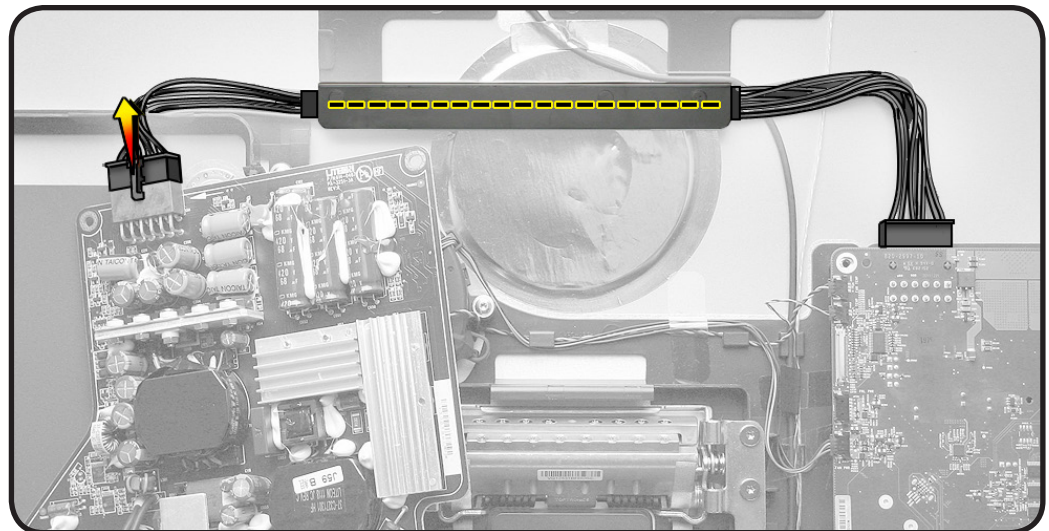
- (2) 922-8685, short (S),
machine, at right



- 2 Disconnect 2 cables
below power supply.



- 3 Lift up power
supply, flip over and
disconnect DC power
cable.





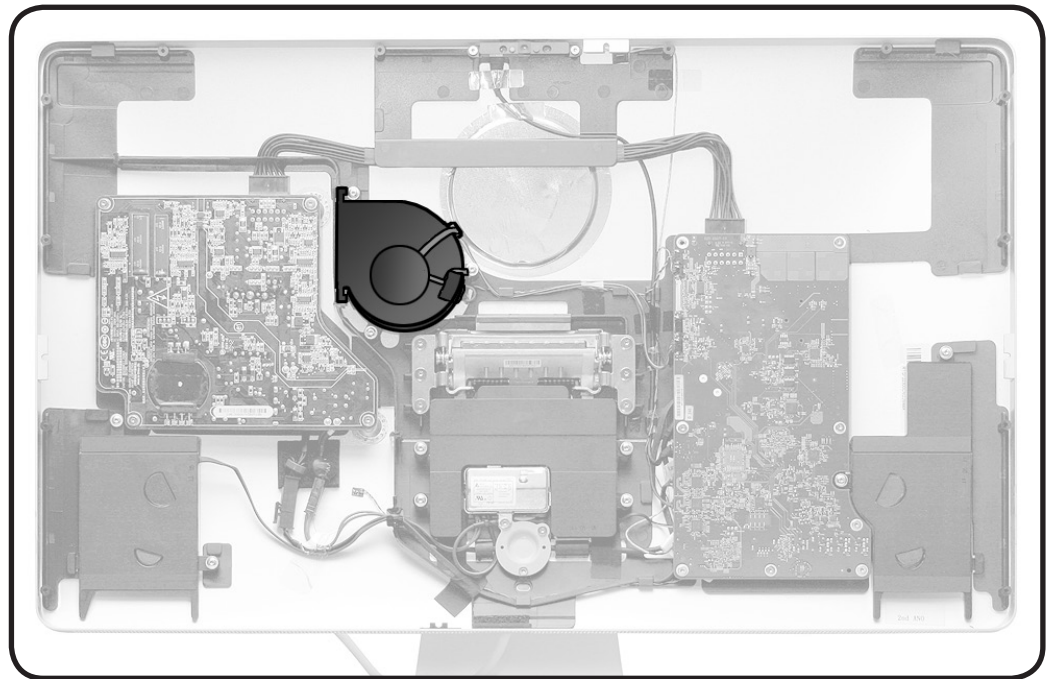
Fan

First Steps

Remove:

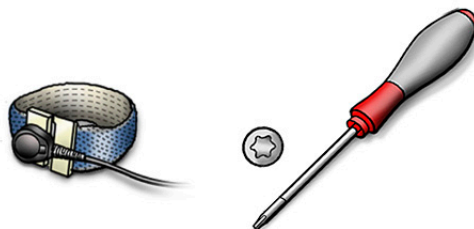
- [Glass Panel](#)
- [LCD Panel](#)

Note: A new fan includes new tape for securing the fan sensor cable.



Tools

- ESD wrist strap
- Torx T10 screwdriver



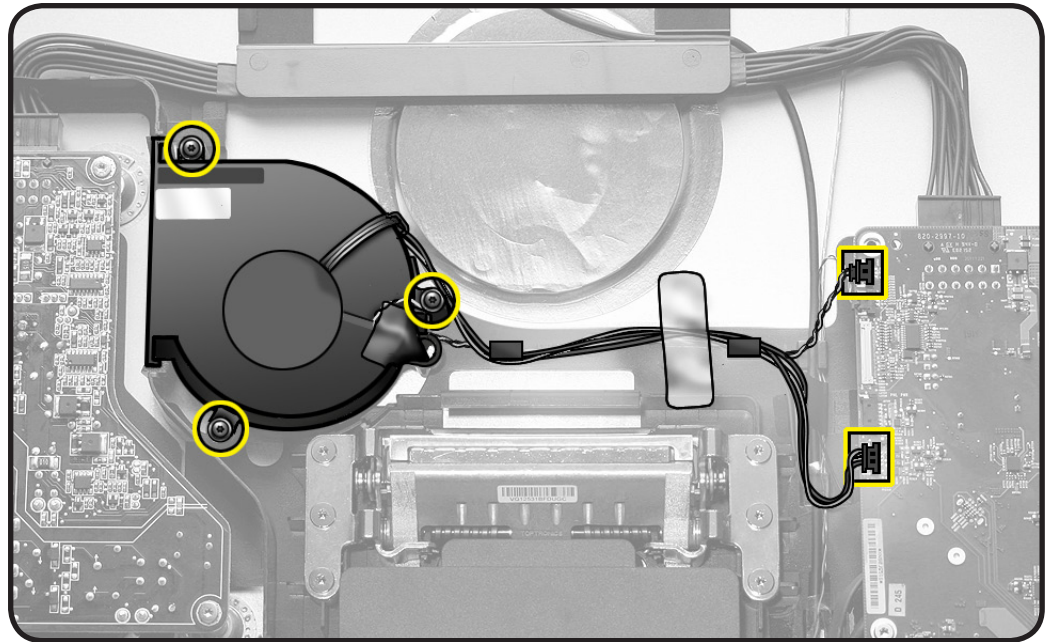


Removal

- 1 Remove T10 screws:
(3) 923-0007



- 2 Disconnect 2 cables
from top side of logic
board:
 - fan cable (4-pin)
 - fan sensor cable (3-pin)

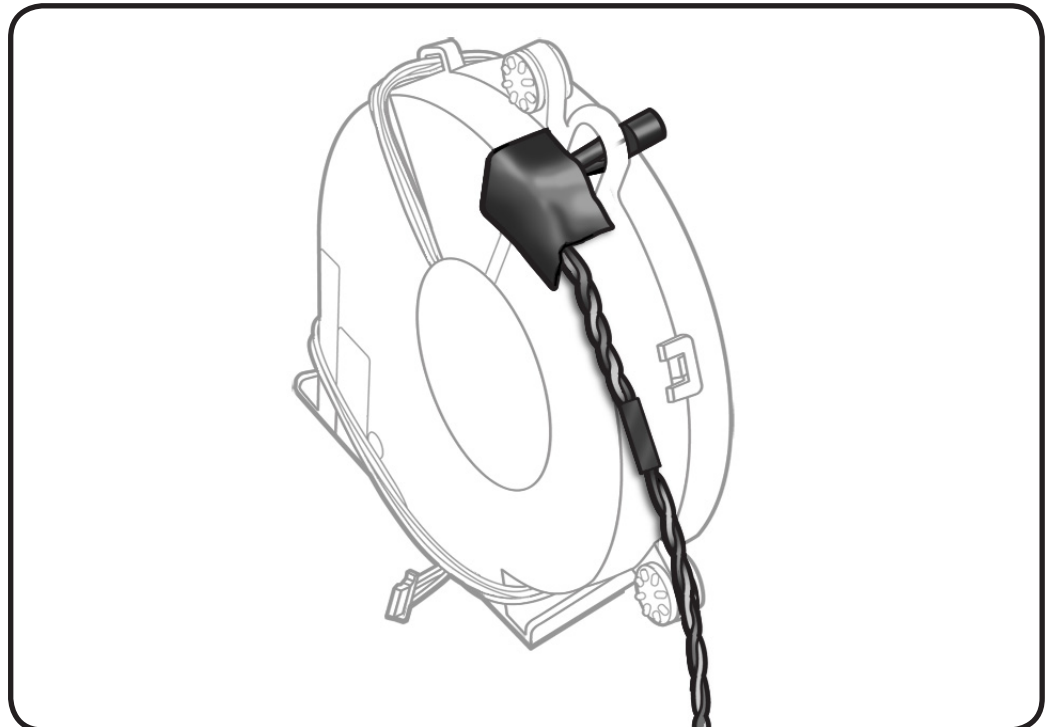


- 3 Remove fan sensor
cable from fan.

Reassembly Note:

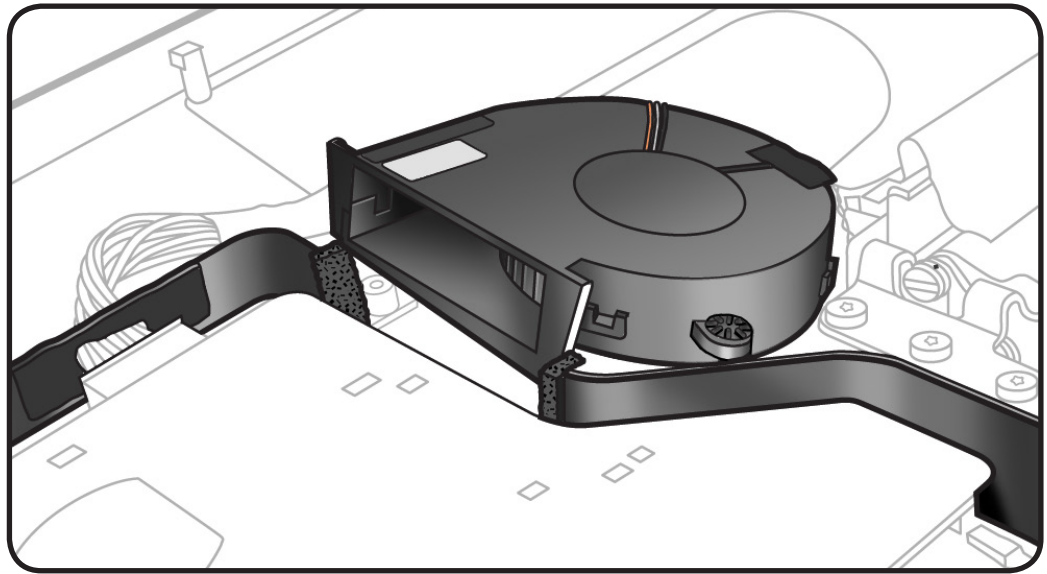
Fan sensor must extend
exactly 1cm from plastic
retaining ring on fan
so that it will sit the
proper distance from rear
housing when installed.

Incorrect sensor
placement can lead to
false temperature readings
and unusual fan behavior.



**Reassembly Note:**

Ensure fan fits securely into foam on rear housing for a snug fit. Air leaks in pressure wall can lead to temperature and/or noise issues.



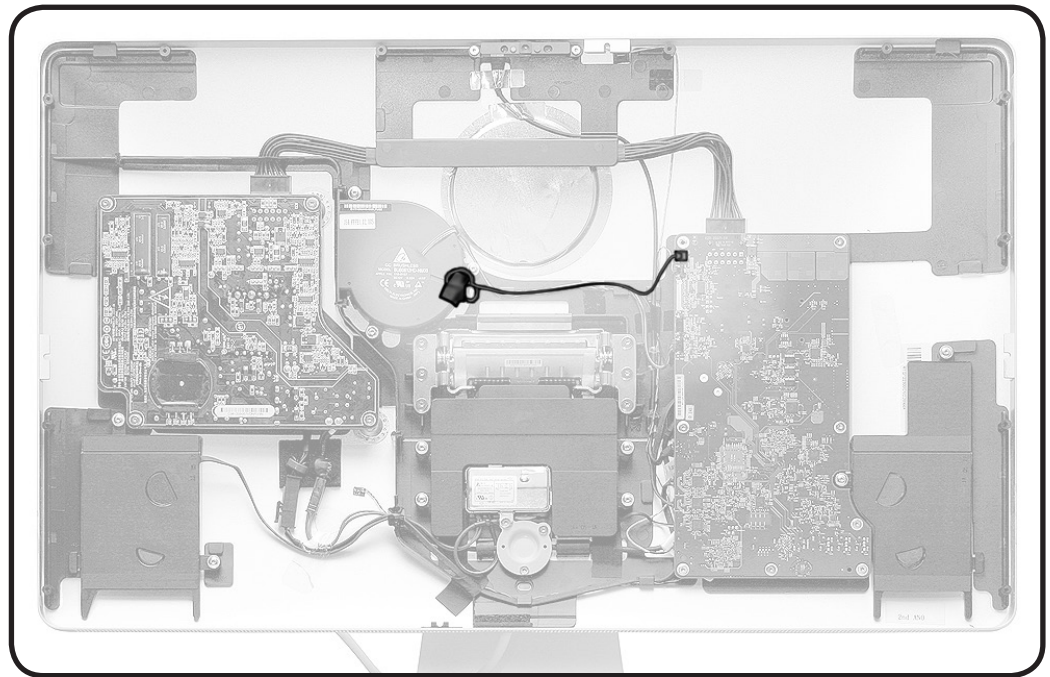


Fan Sensor Cable

First Steps

Remove:

- [Glass Panel](#)
- [LCD Panel](#)
- [Fan](#)



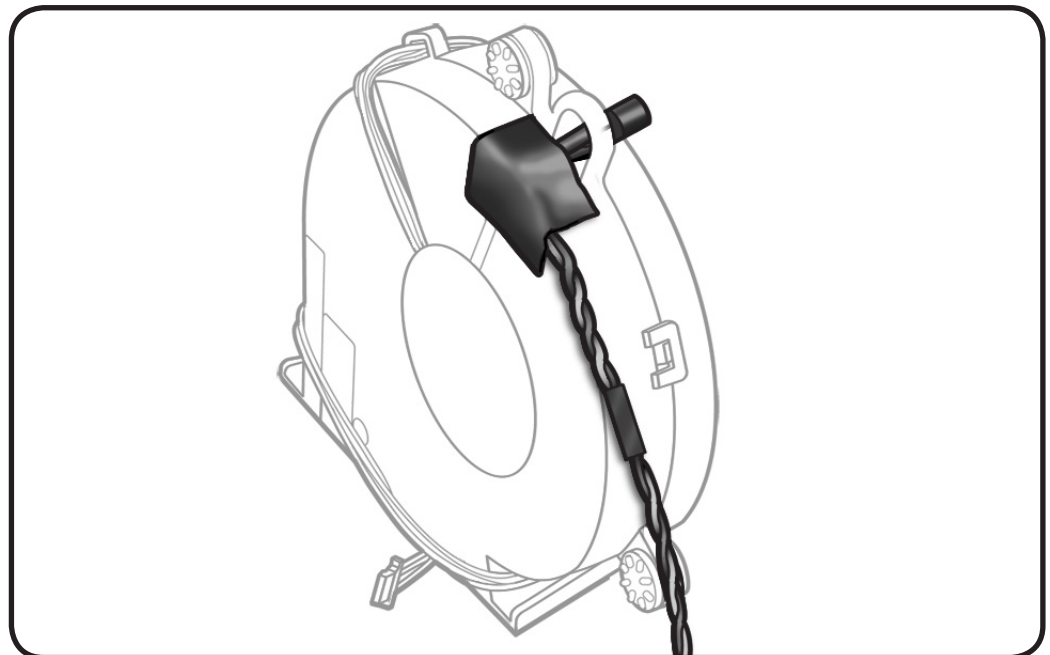
Removal

- 1 Remove fan sensor cable from fan, preserving black tape for reuse.

Reassembly Note:

Fan sensor must extend exactly 1cm from plastic retaining ring on fan so that it will sit the proper distance from rear housing when installed.

Incorrect sensor placement can lead to false temperature readings and unusual fan behavior.





Logic Board

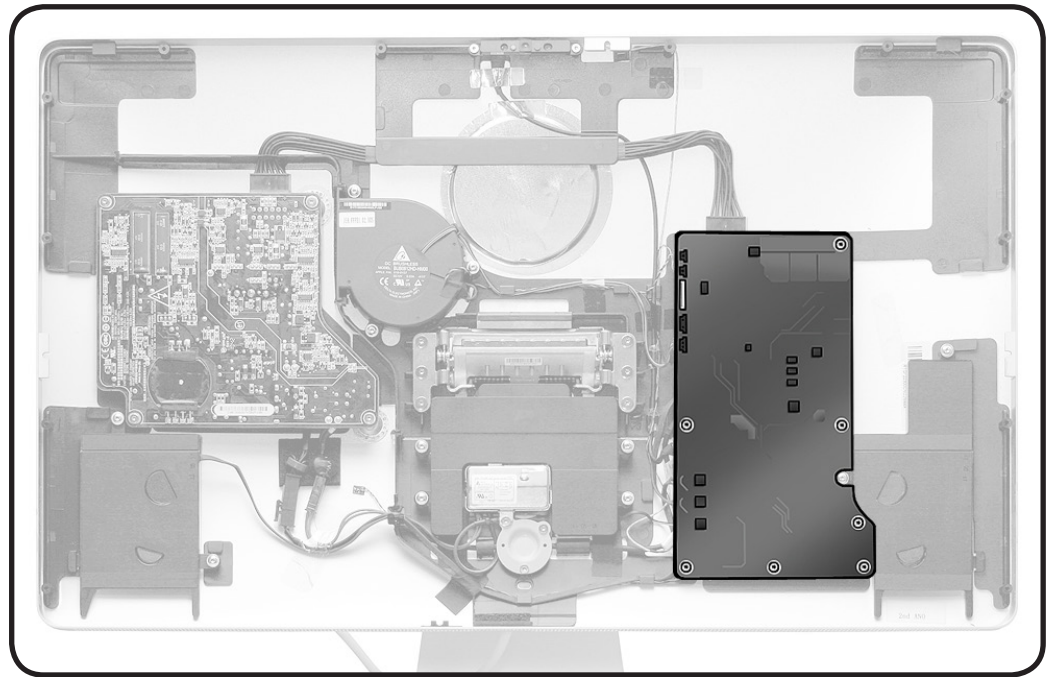
First Steps

Remove:

- [Glass Panel](#)
- [LCD Panel](#)



Warning: HIGH VOLTAGE:
Use extreme caution
when working around
the logic board if unit is
plugged in.

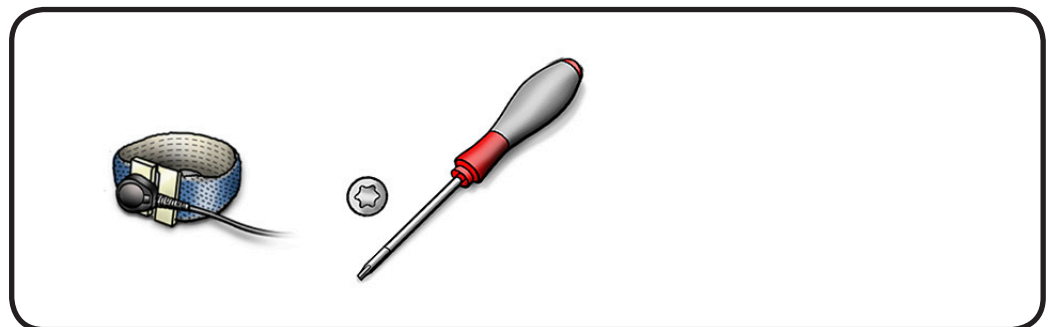


Important: If replacing the logic board with a new part, match the display's serial number CCCC code with the correct logic board part number and corresponding EEEE code.

Display Serial# CCCC Code	Logic Board Part#	Part Config EEEE Code
DJGR	661-6060	DHMY
F2GC	661-6489	DYW6

Tools

- ESD wrist strap
- Torx T10 screwdriver





Removal

- 1 Remove T10 screws:
(7) 923-0006



(top left screw was removed with LCD ground cable)

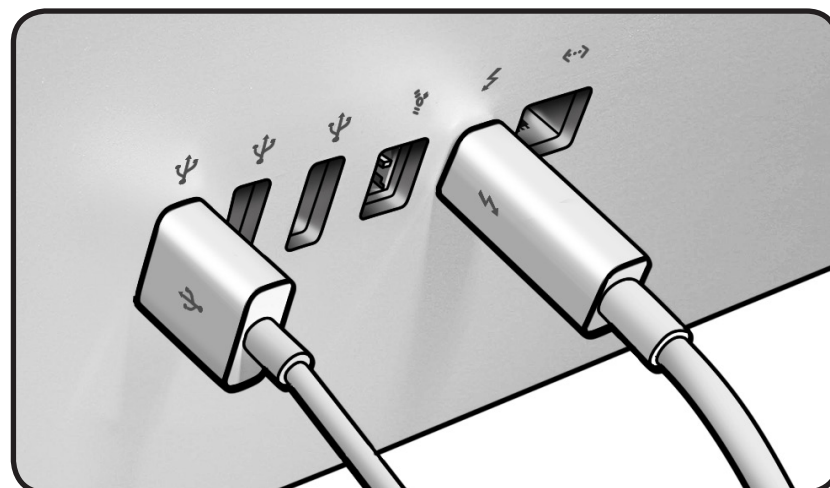
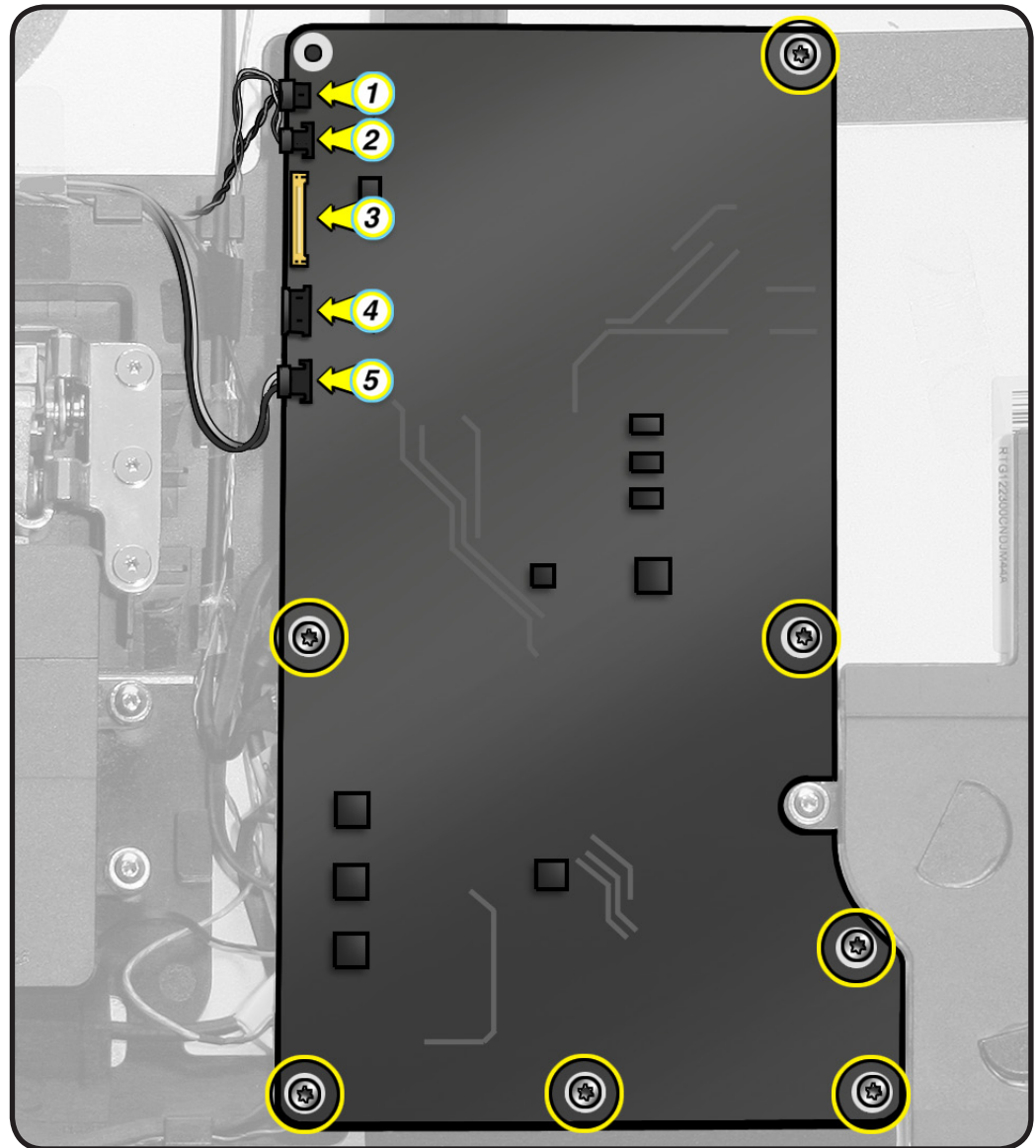
- 2 Disconnect cables on front side of logic board:
 - (1) fan sensor 3-pin
 - (2) power supply sensor, 2-pin
 - (5) fan, 4-pin

Note: DisplayPort (3) and DisplayPort power (4) cables should have been disconnected already.



IMPORTANT Reassembly

Note: The Thunderbolt port has a precise fit. To properly align logic board with rear housing, you **MUST** plug in cables to the Thunderbolt port and also to the furthest left USB port while tightening screws.

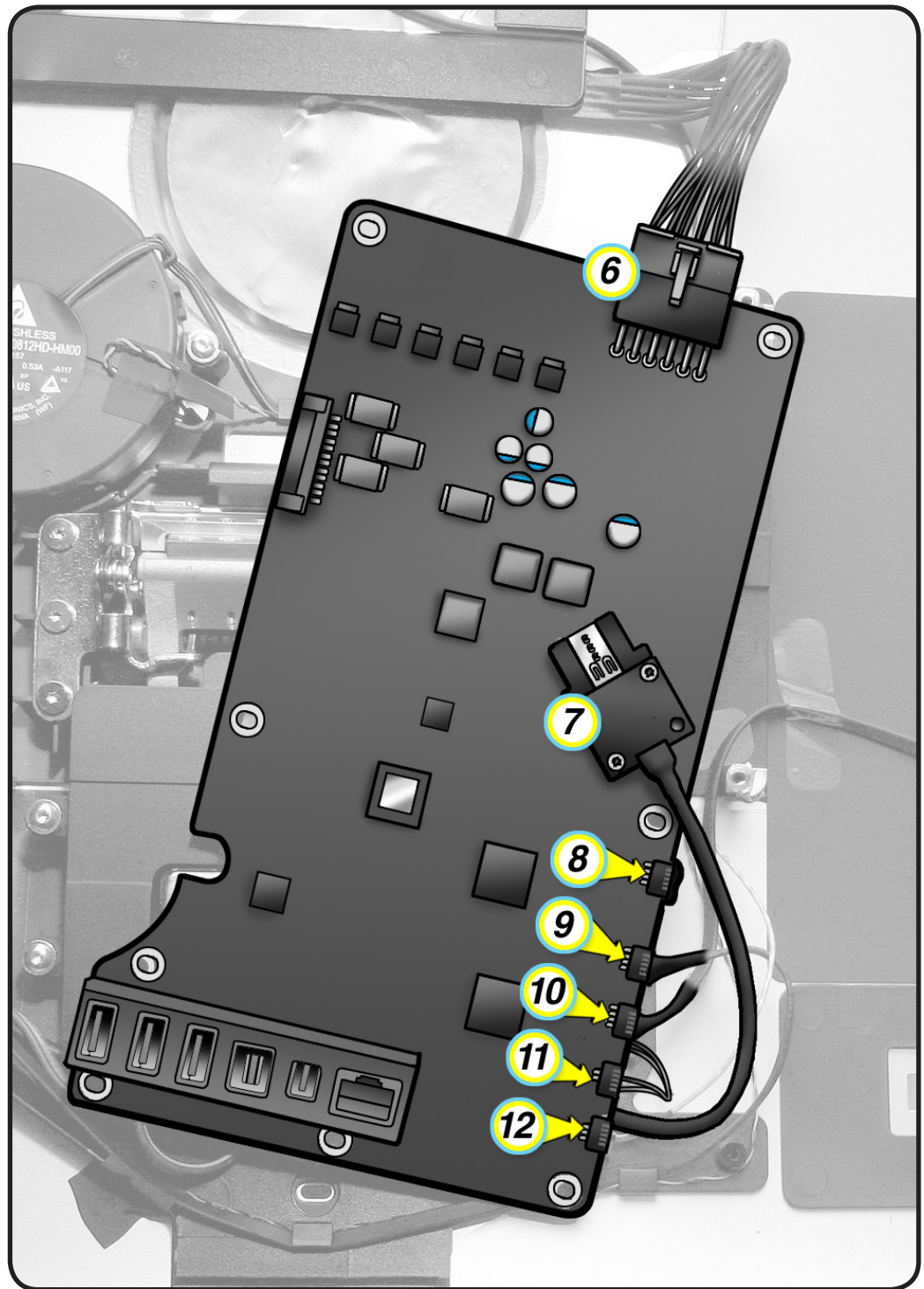




3 Flip logic board over and disconnect cables on back side.

- (6) DC power
- (8) camera, 7-pin
- (9) left speaker, 5-pin
- (10) right speaker, 4-pin
- (11) subwoofer, 2-pin
- (12) microphone, 3-pin

See next page for instructions to remove
(7) All-in-One uplink

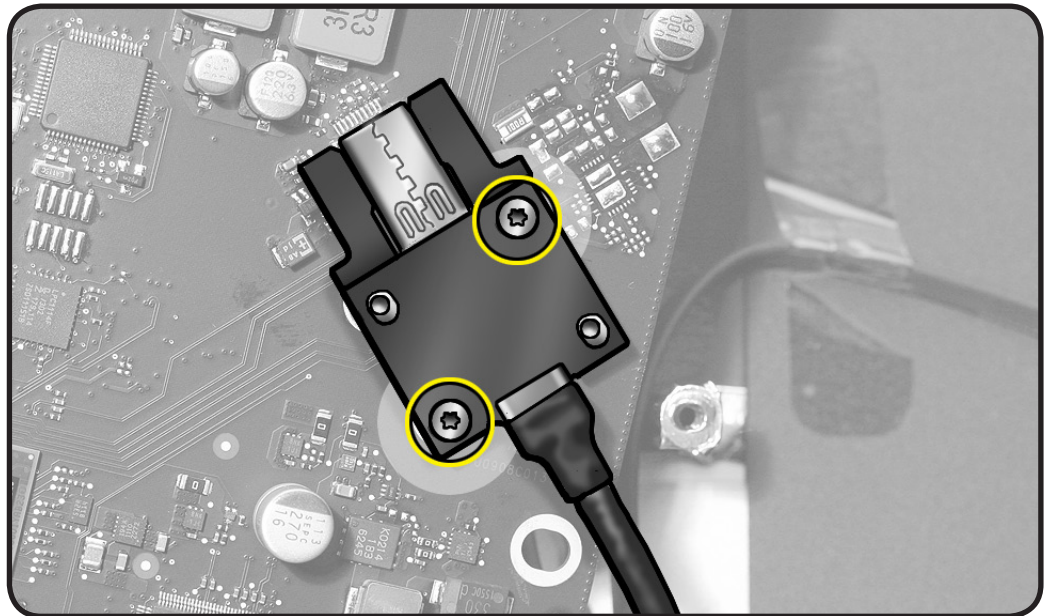
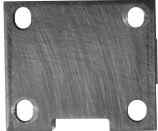




- 4 Remove T6 screws:
(2) 923-0008

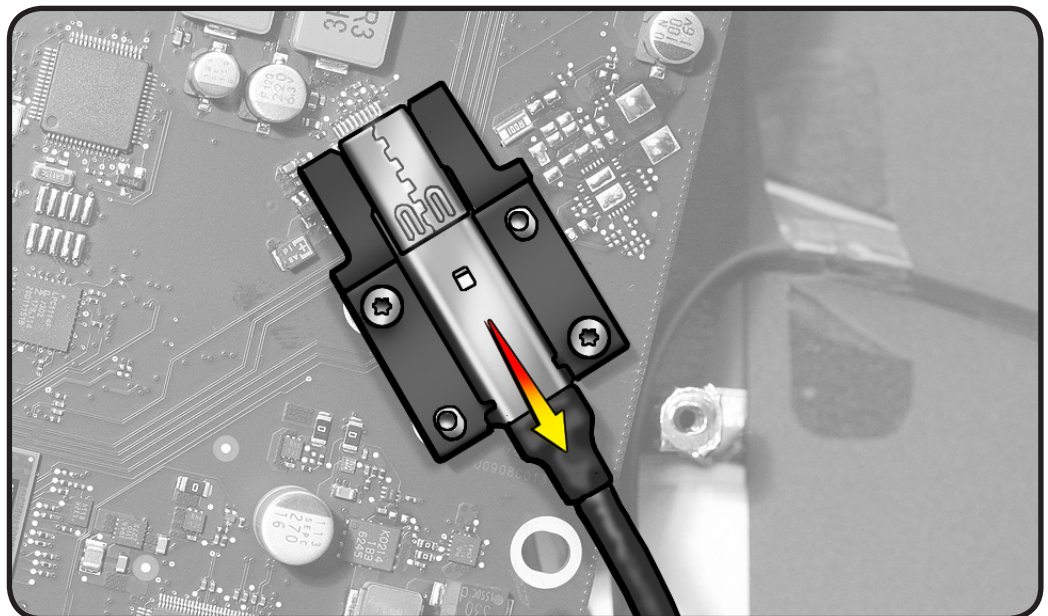


from Clamp, All-In-One
Cable Uplink, Top
923-0020



- 5 Disconnect All-in-One
cable uplink.

Note: The bottom
clamp and screws are
part of the logic board
and cannot be ordered
separately.



Important Replacement Notes:

- After installing a new logic board, check for and install any available Thunderbolt Display firmware updates **prior to returning display to the user**.
- Apply new Ethernet ID label (included in box with new logic board) to bottom of stand.

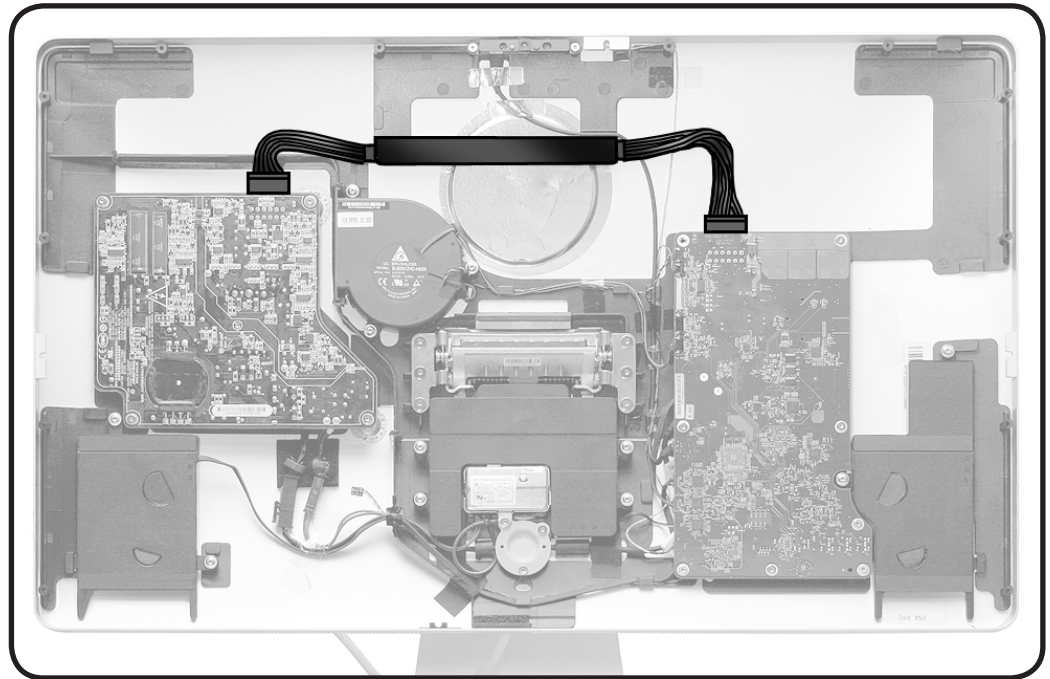


DC Power Cable

First Steps

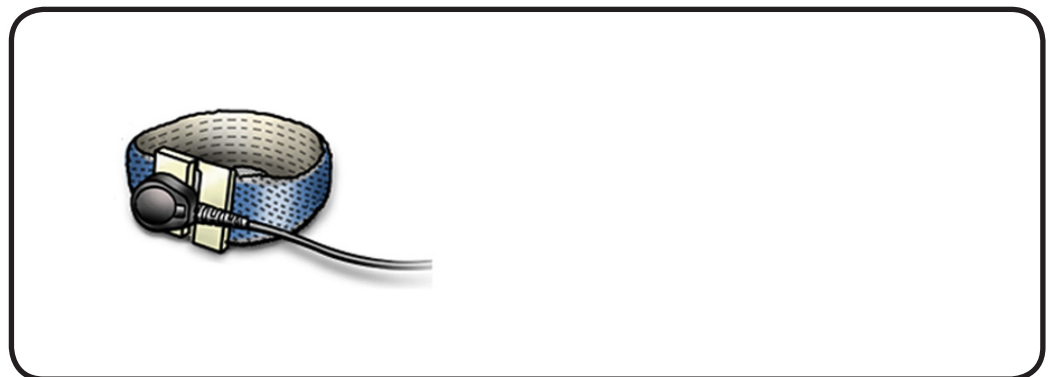
Remove:

- [Glass Panel](#)
- [LCD Panel](#)
- [Power Supply](#)
- [Logic Board](#)



Tools

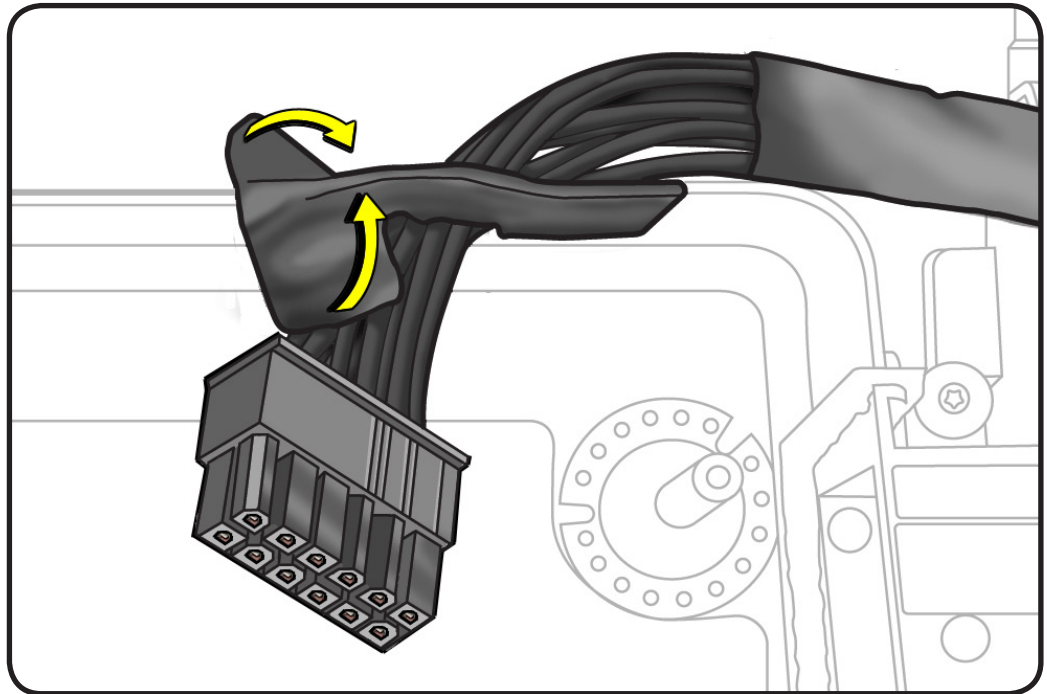
- ESD wrist strap





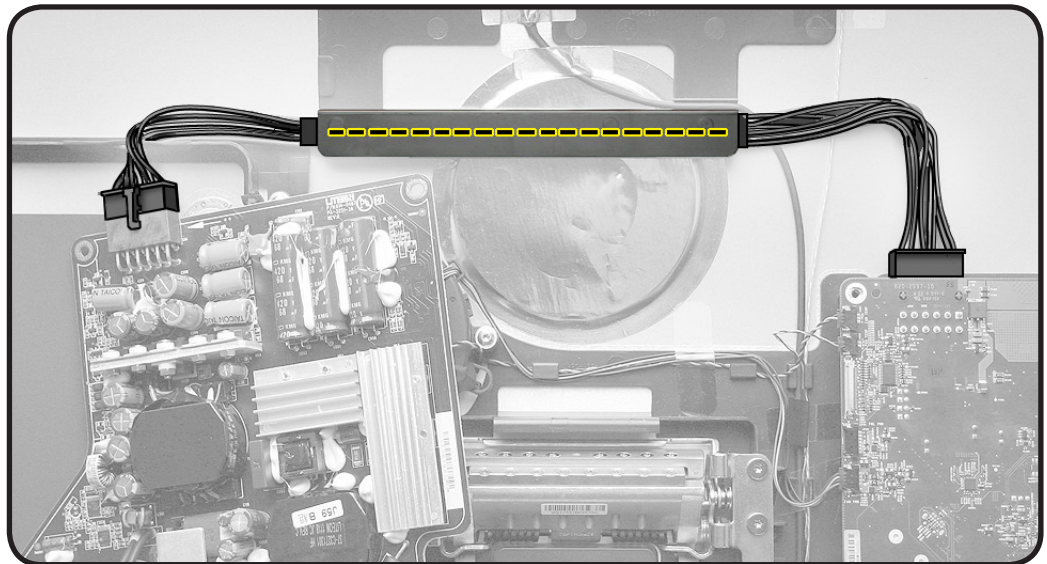
Removal

- 1 Carefully remove and save “H” tape securing cable to pressure wall above power supply. This tape will be reused during reassembly.
- 2 Lift cable out of rear housing.



Reassembly Note:

Cable routes through long flat black plastic guide in rear housing.





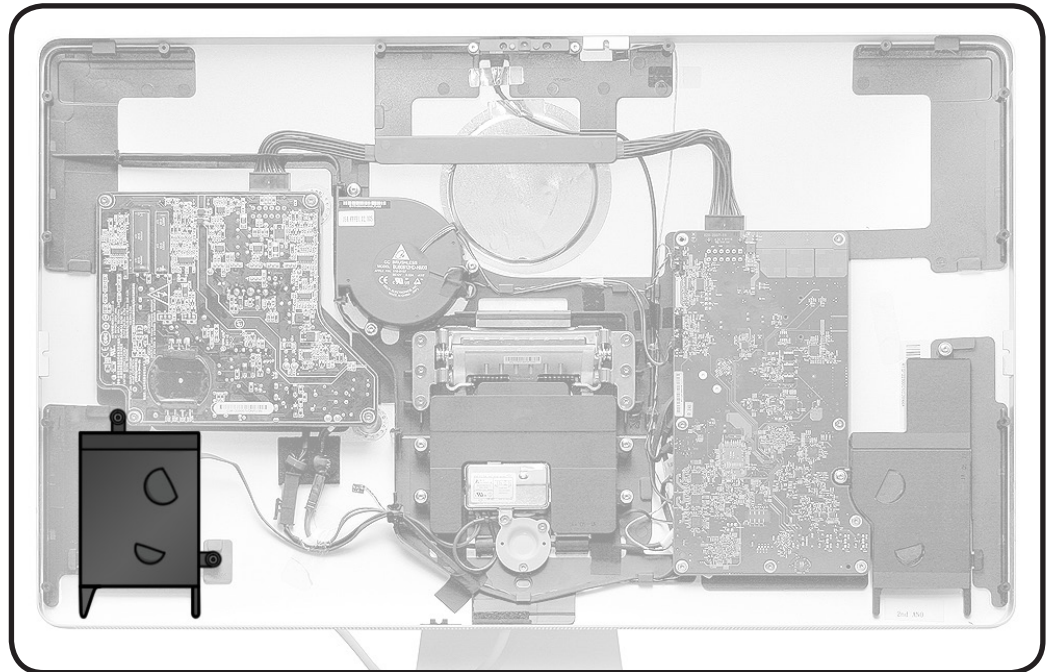
Left Speaker

First Steps

Remove:

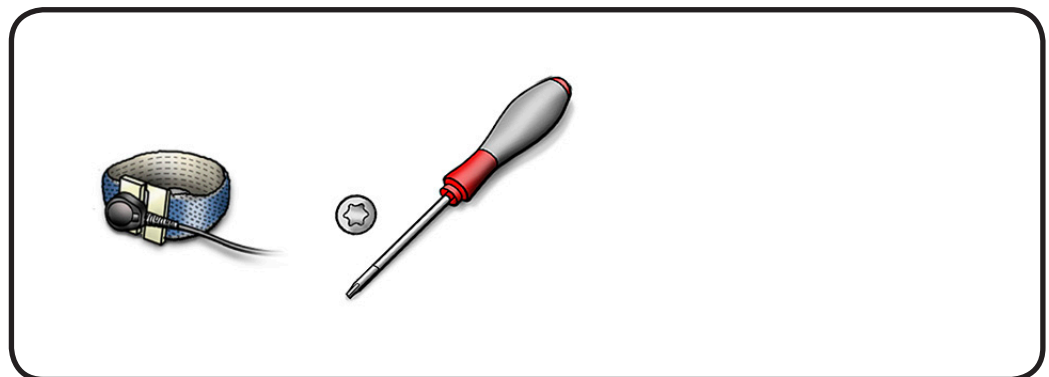
- [Glass Panel](#)
- [LCD Panel](#)

Note: A new left speaker includes a new “H” tape for the pressure wall.



Tools

- ESD wrist strap
- Torx T10 screwdriver



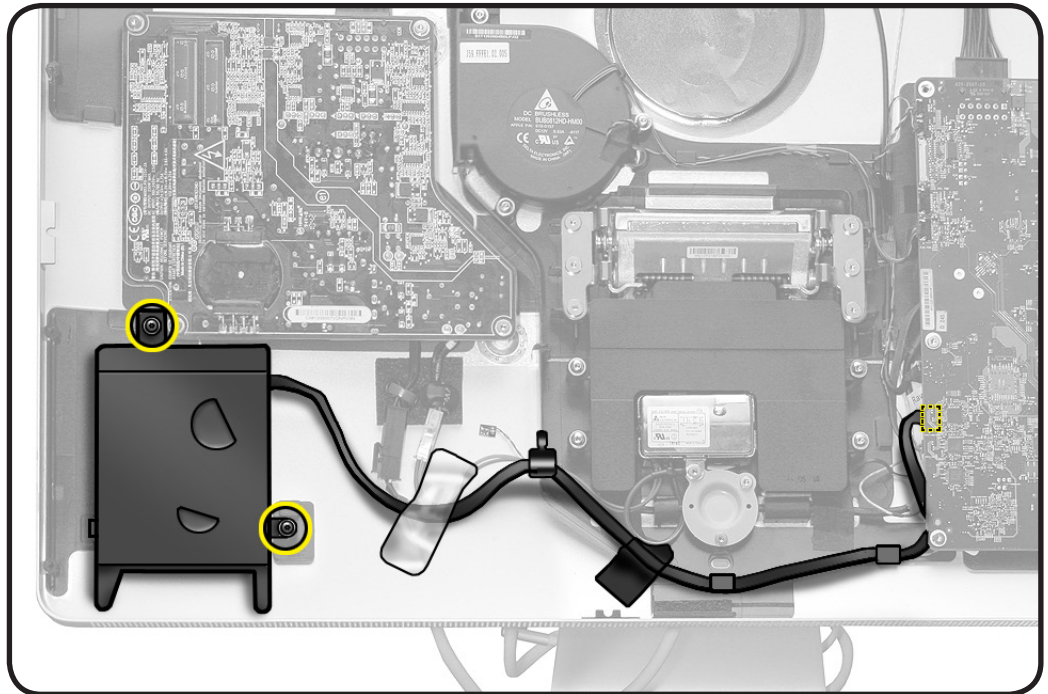


Removal

- 1 Remove T10 screws:
(2) 923-0007

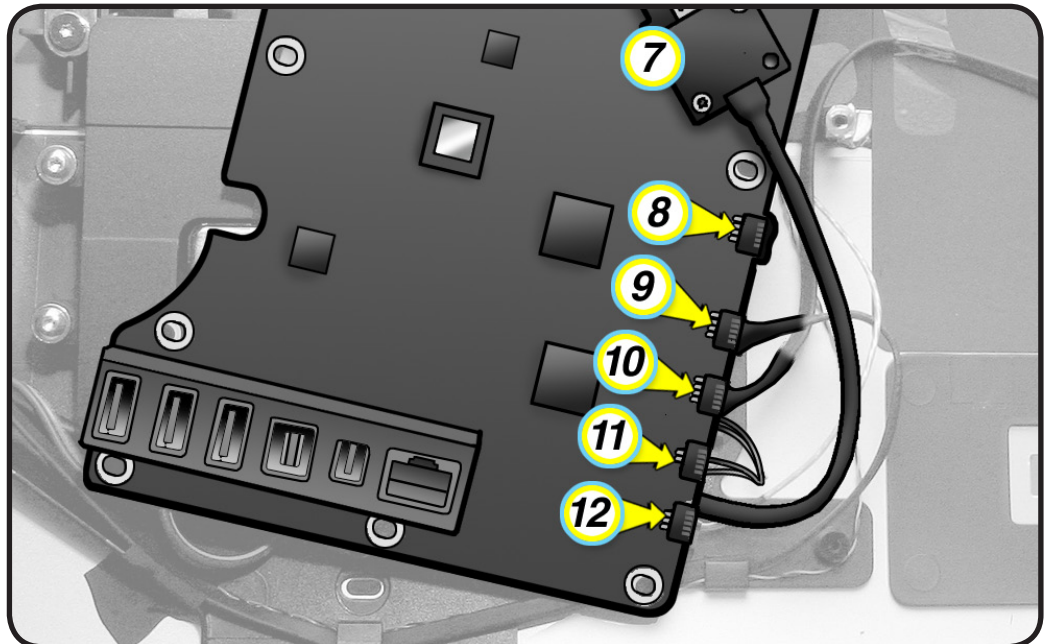


- 2 Note cable routing and tape placement along rear housing.
- 3 Remove cable from tape and plastic guides.
- 4 Disconnect 5-pin speaker cable from logic board.



Reassembly Note:

For easier access to reconnect left speaker cable (9), unscrew and flip over logic board.



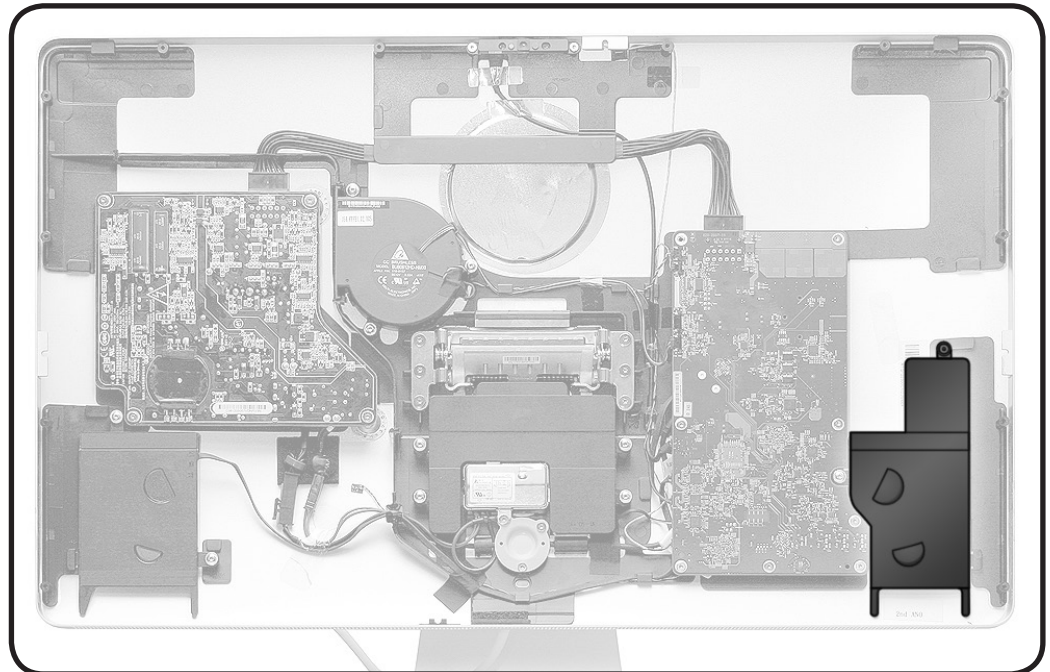


Right Speaker

First Steps

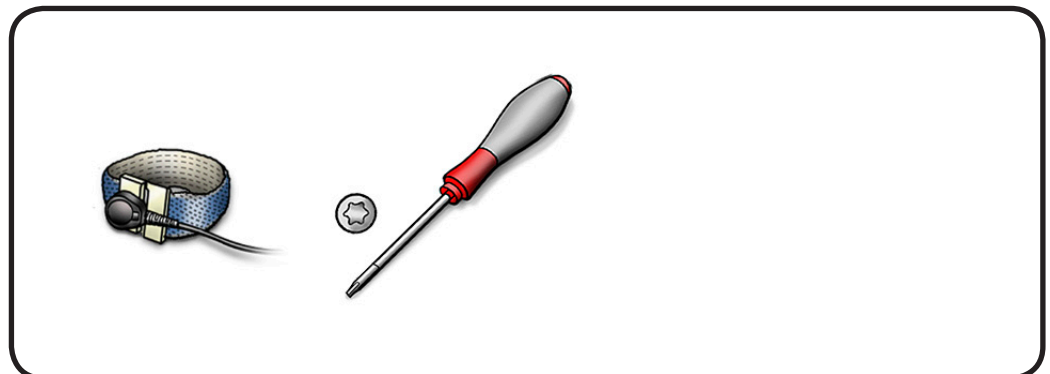
Remove:

- [Glass Panel](#)
- [LCD Panel](#)
- [Logic Board](#) (remove screws & flip over)



Tools

- ESD wrist strap
- Torx T10 screwdriver





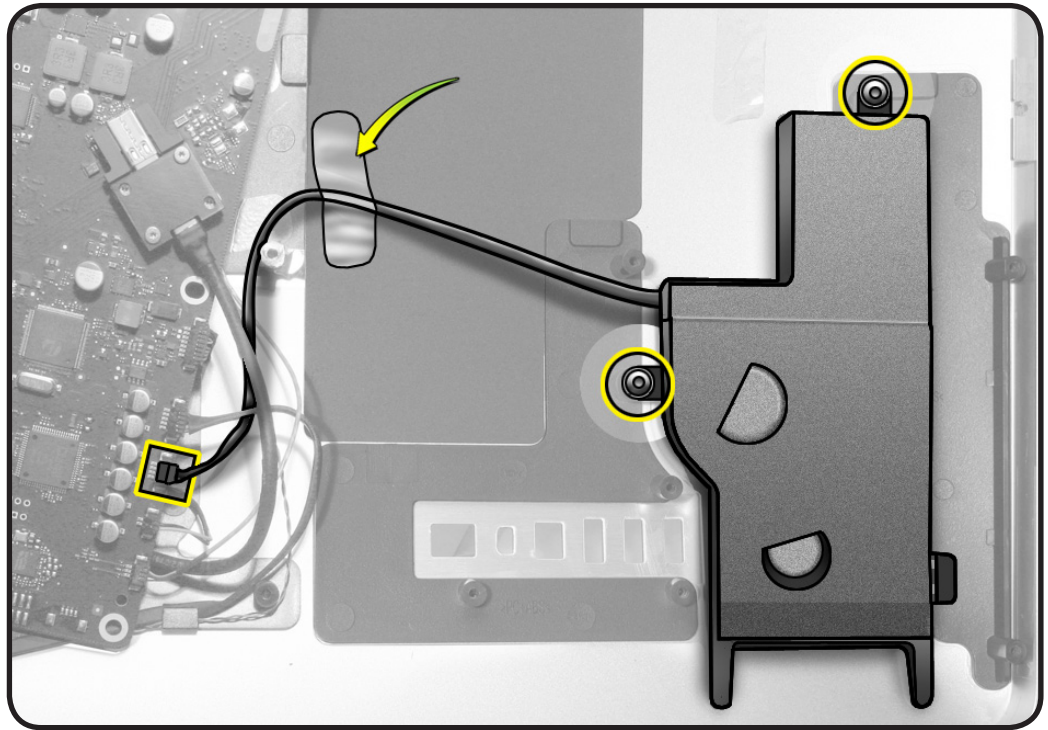
Removal

- 1 Remove T10 screws:
(2) 923-0007



- 2 Note cable routing and tape on rear housing.

- 3 Remove speaker from rear housing.



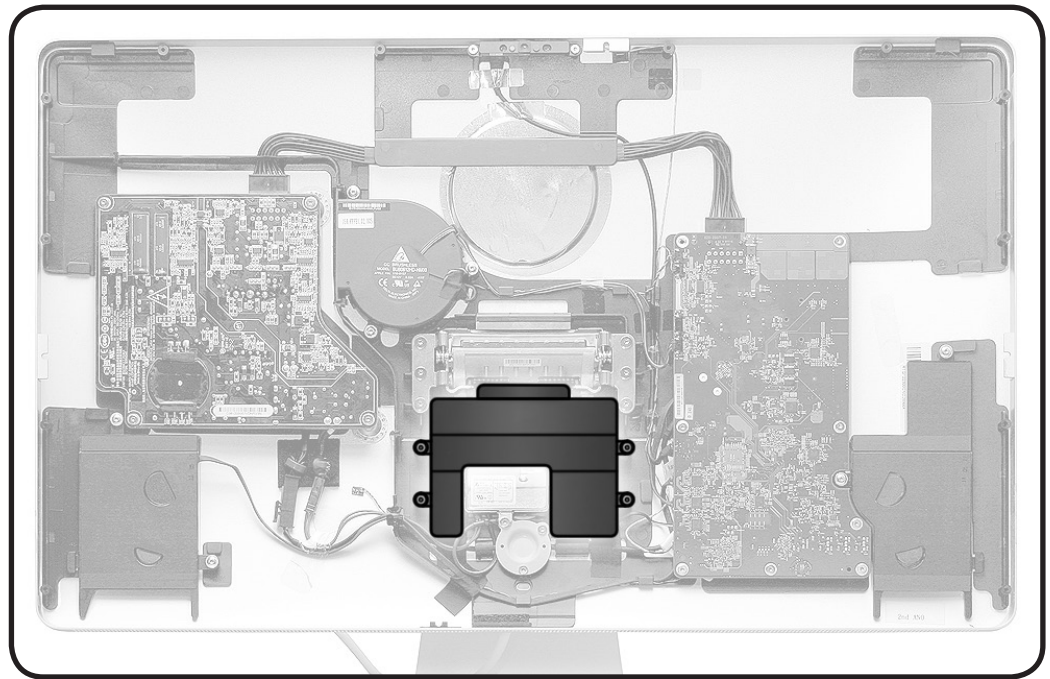


Subwoofer

First Steps

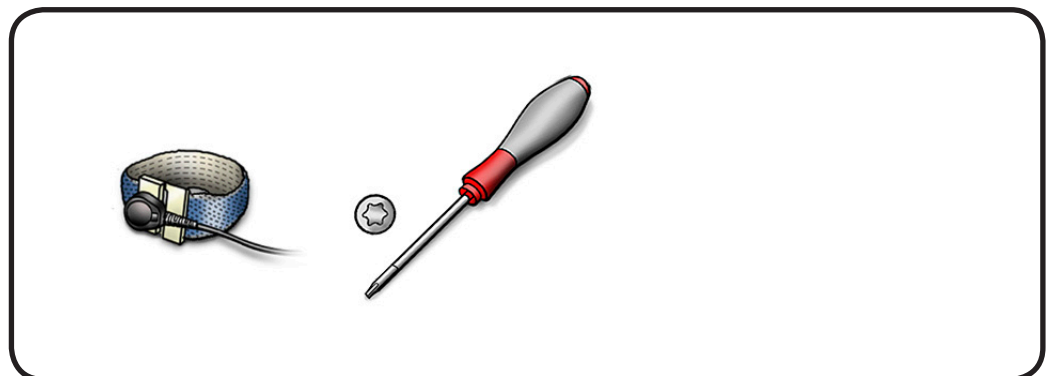
Remove:

- [Glass Panel](#)
- [LCD Panel](#)



Tools

- ESD wrist strap
- Torx T10 screwdriver



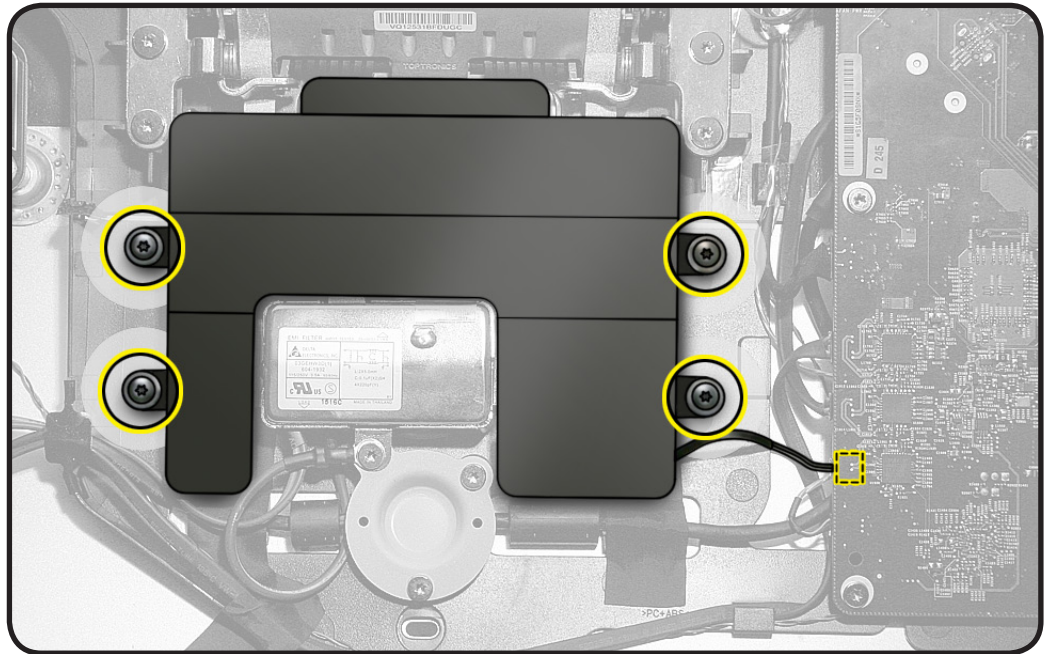


Removal

- 1 Remove T10 screws:
(4) 922-9722

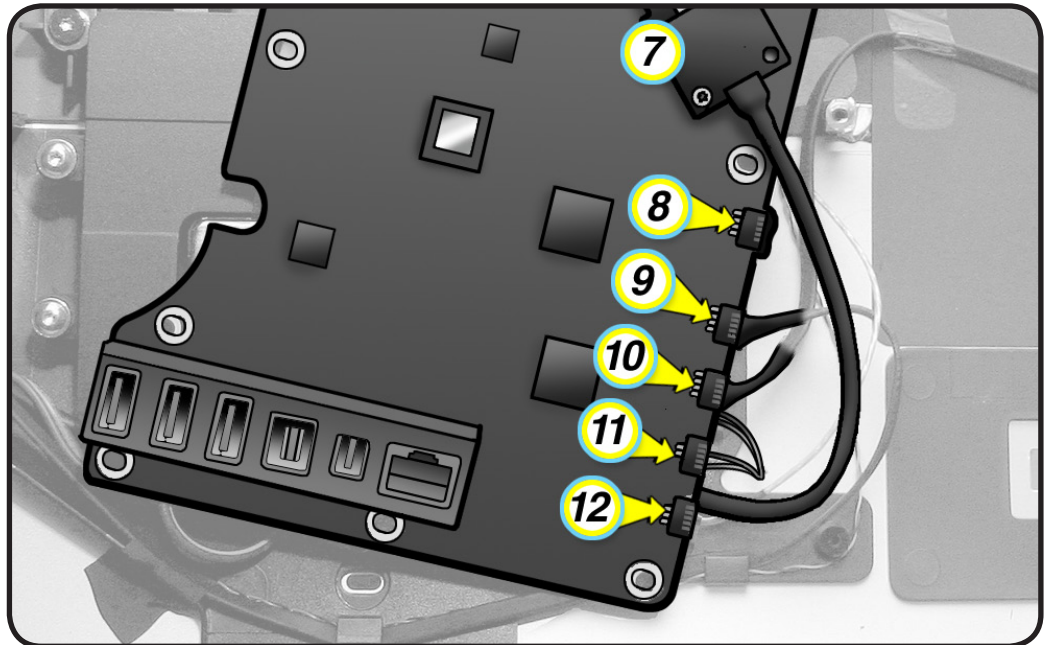


- 2 Disconnect 2-pin subwoofer cable from logic board
- 3 Remove subwoofer from rear housing.



Reassembly Note:

For easier access to reconnect subwoofer cable (11), unscrew and flip over logic board.





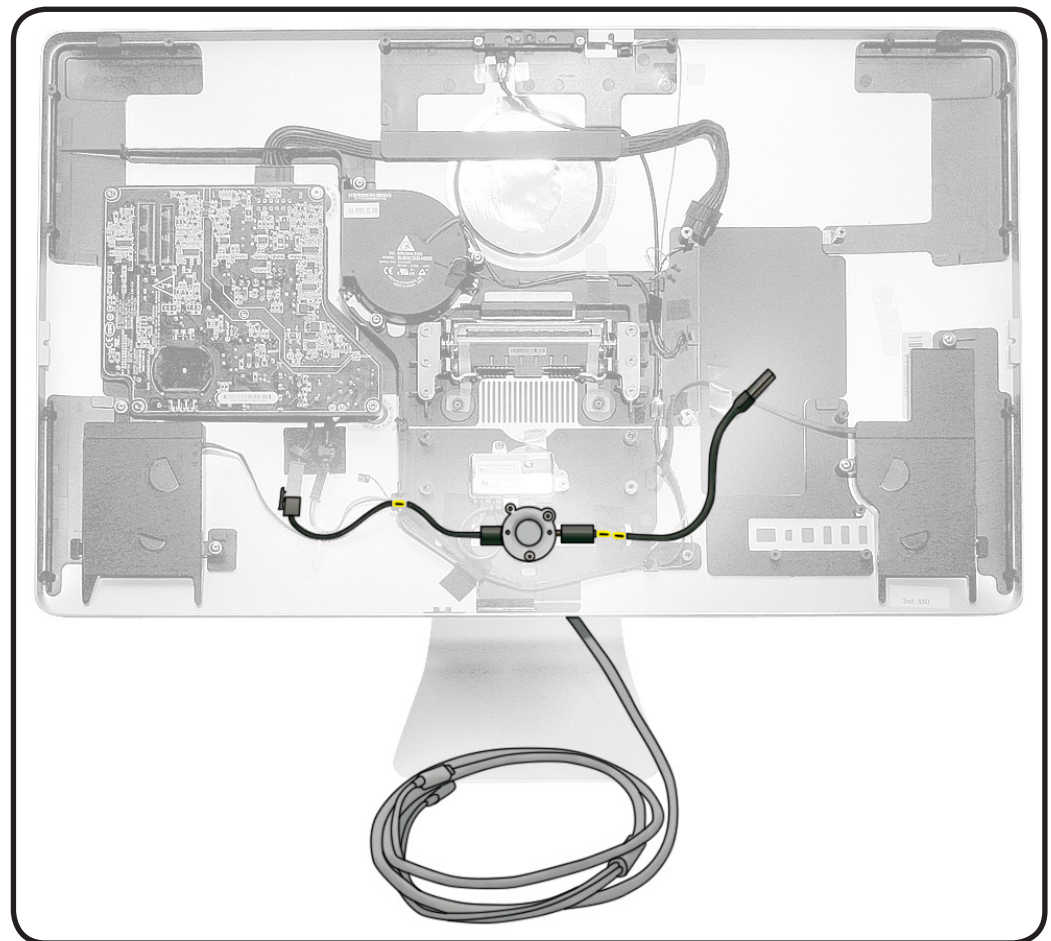
All-in-One Cable

First Steps

Remove:

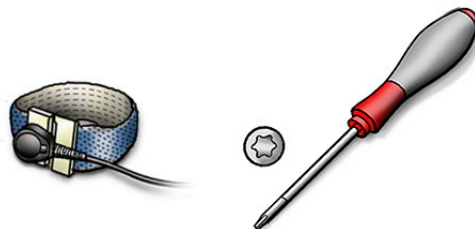
- [Glass Panel](#)
- [LCD Panel](#)
- [Logic Board](#)
- [Subwoofer](#)

Note: A new all-in-one cable includes new black fabric tape and a new “H” tape for pressure wall.



Tools

- ESD wrist strap
- Torx T10 screwdriver





Removal

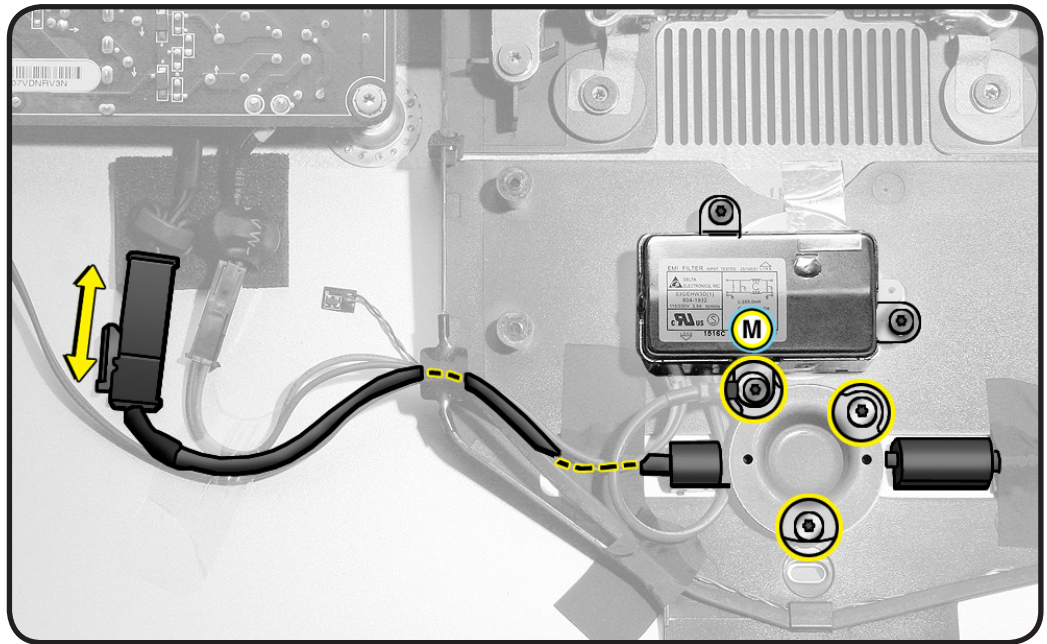
- 1 Disconnect cable from power supply.
- 2 Remove T10 screws:
(1) 922-8685, machine,
top left (also secures
AC inlet)



(2) 922-9351



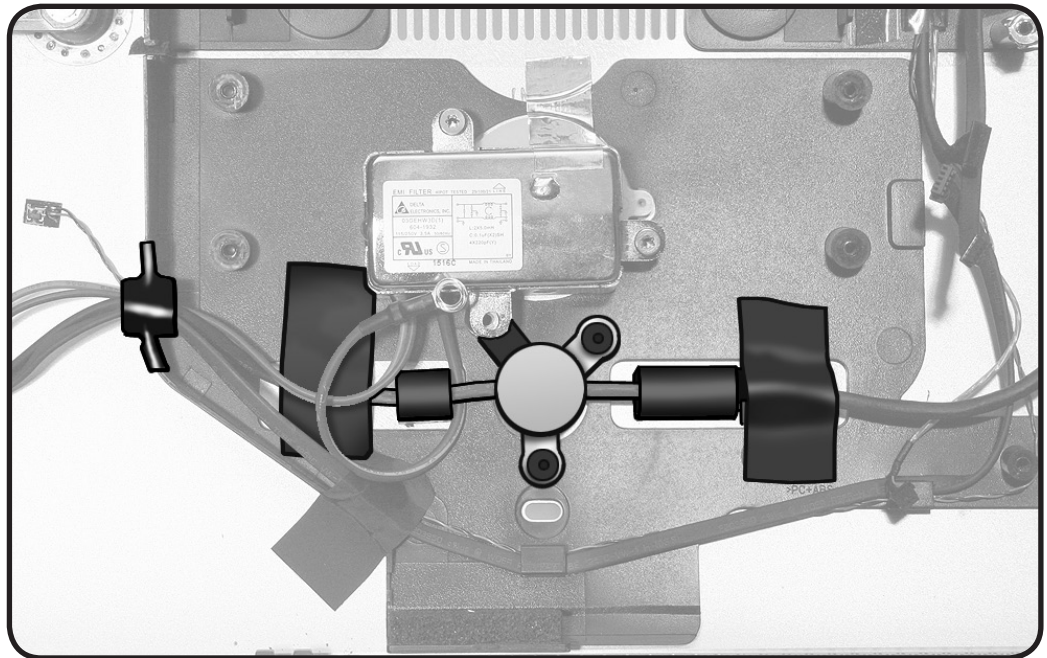
Loosen 2 other T10
screws on AC inlet.



- 3 Remove round metal
bracket.

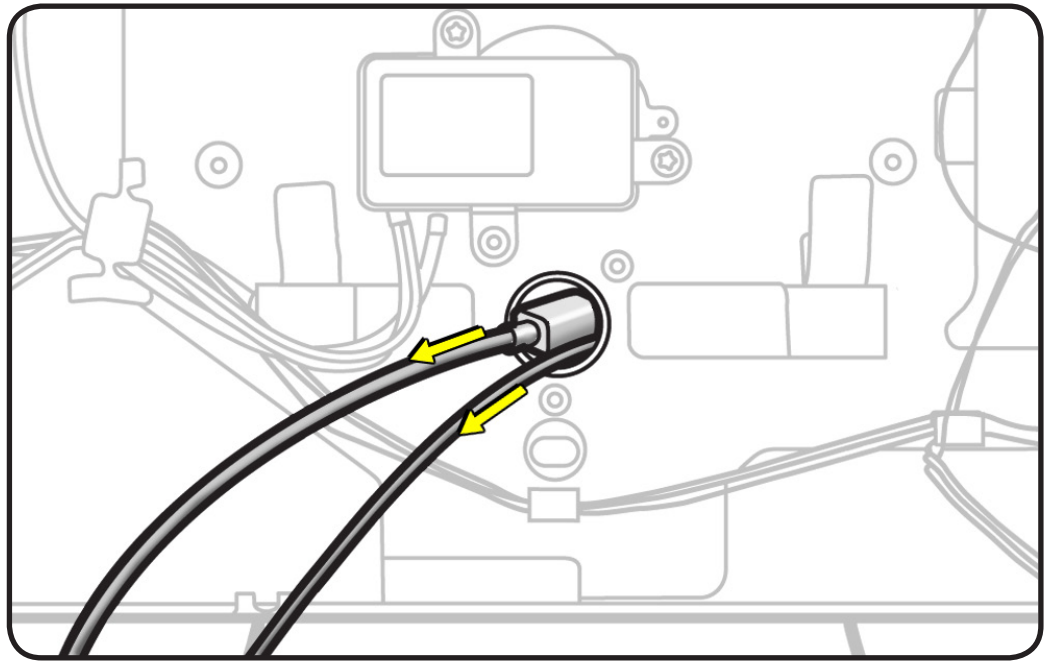
Reassembly Notes:

- Bracket tucks underneath metal tab of AC inlet.
 - AC inlet ground cable routes underneath All-in-One Cable.
- 4 Remove black fabric tape securing cables to rear housing, and “H” tape securing power cable to pressure wall.
 - 5 Unstick black ferrite beads from rear housing.





- 6 Pull cable through opening in rear housing.





Power Supply Sensor Cable

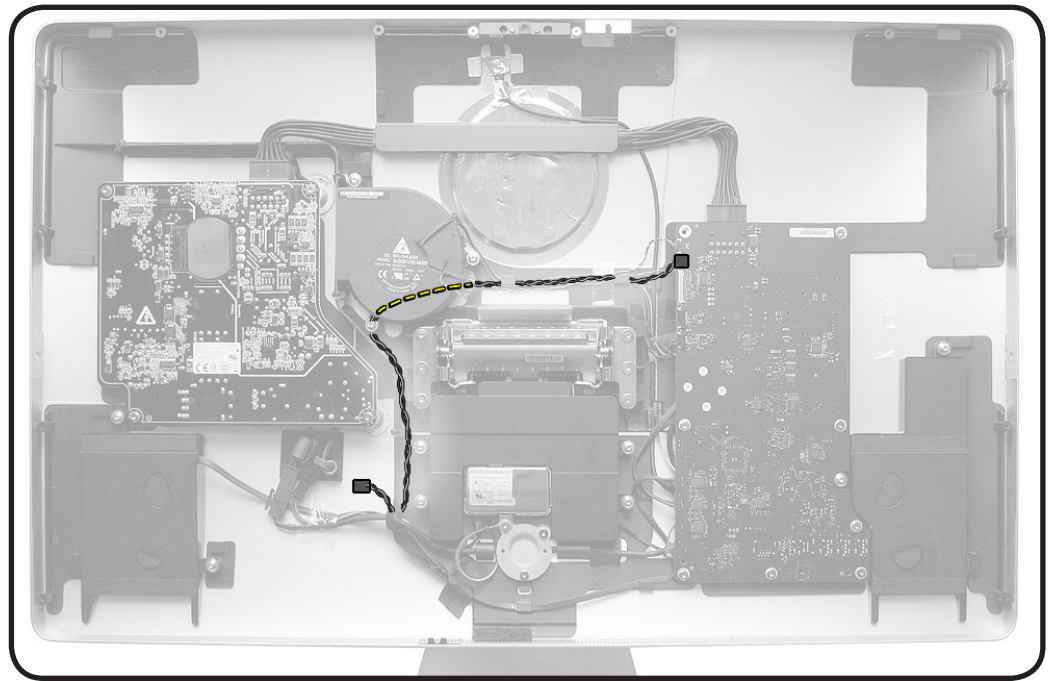
First Steps

Remove:

- [Glass Panel](#)
- [LCD Panel](#)
- [Fan](#)

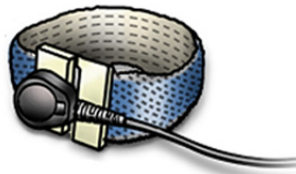
Important: This cable is not present in all units, and is not required for functionality.

The unit you are repairing may have no Power Supply Sensor Cable, or may have different cable routing than shown here. See alternate routing on next page.



Tools

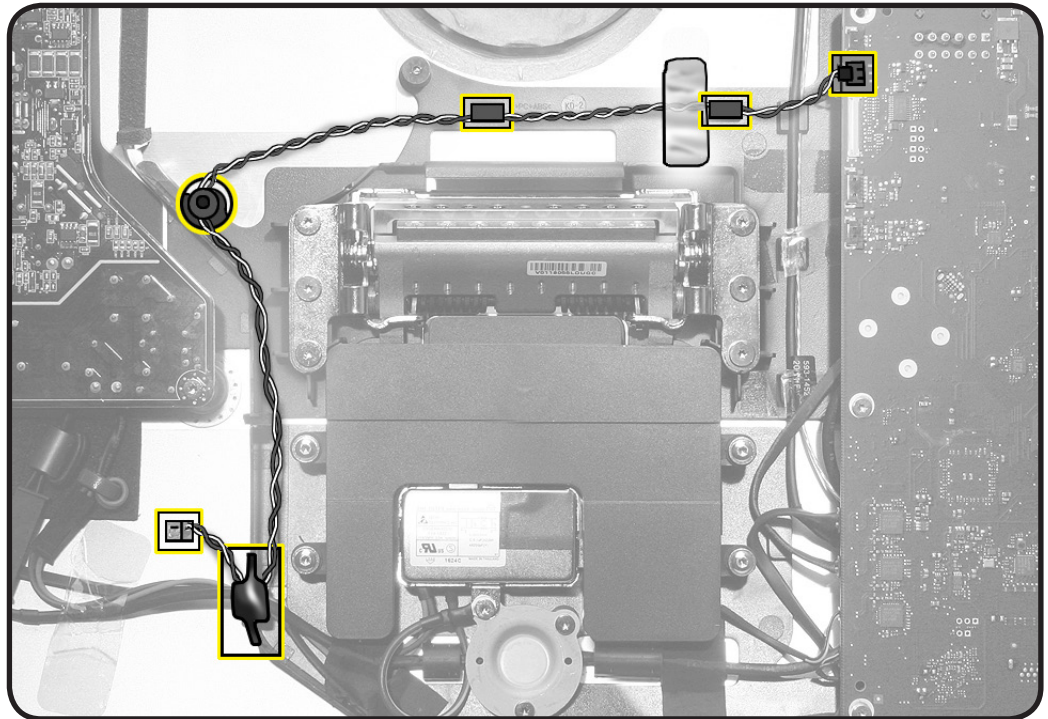
- ESD wrist strap





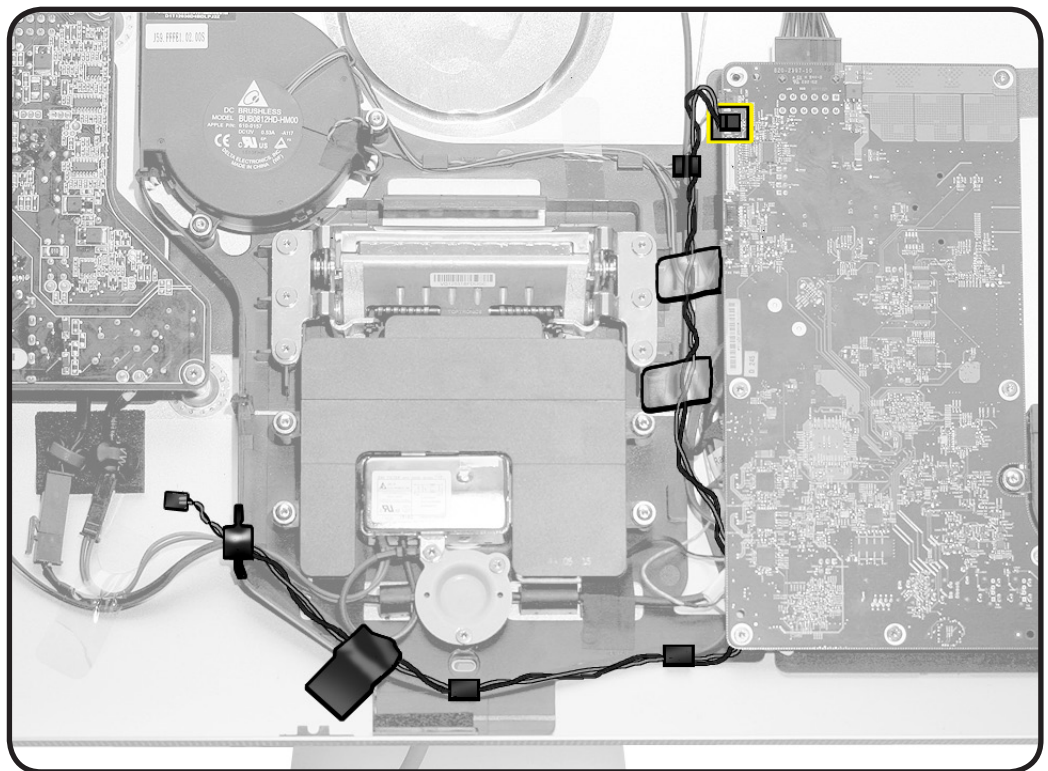
Removal

- 1 Note cable routing and tape placement. The cable routes around one of the fan screw bosses.
- 2 Remove cable from tape and plastic guides.
- 3 Disconnect cable from logic board.



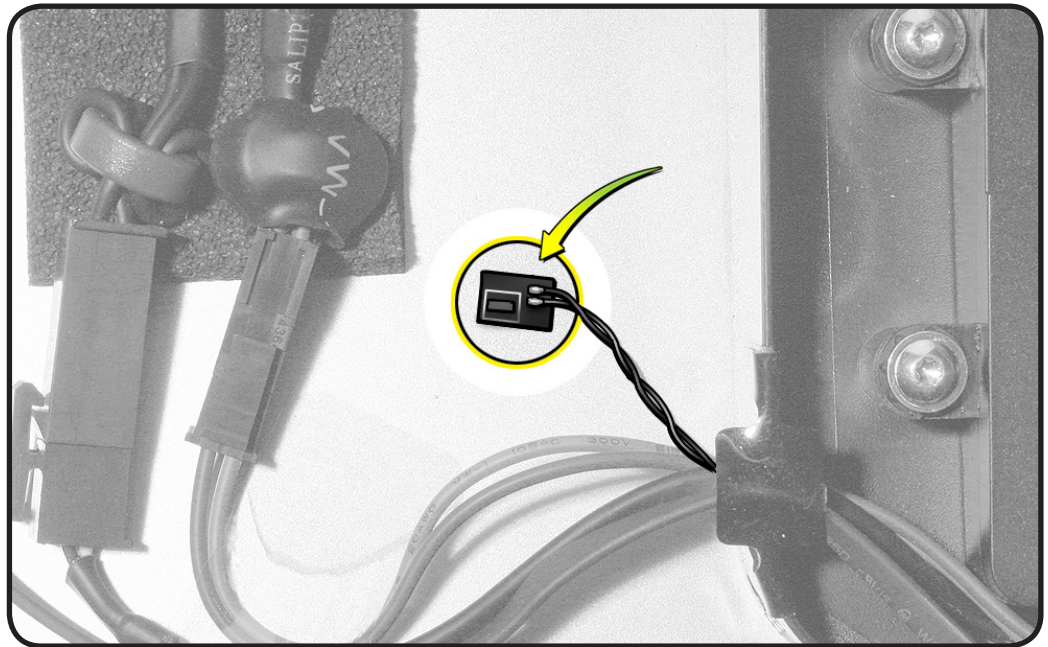
Alternate Cable Routing:

The unit you are repairing may have a Power Supply Sensor Cable routed in either of these two configurations.





- 4 Peel up sensor from rear housing.



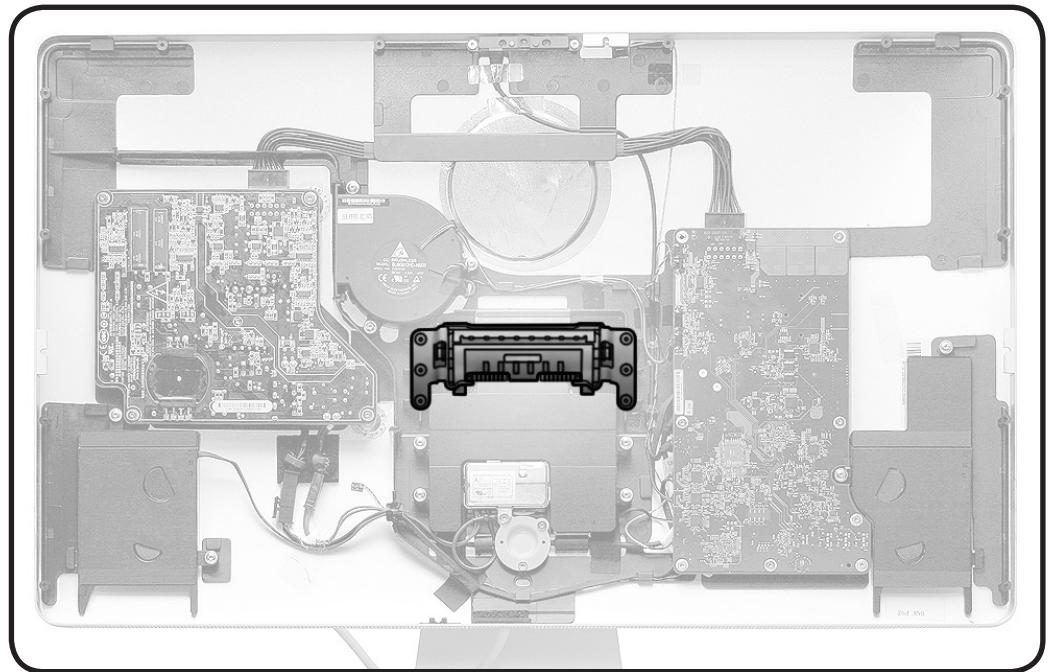


Mechanism

First Steps

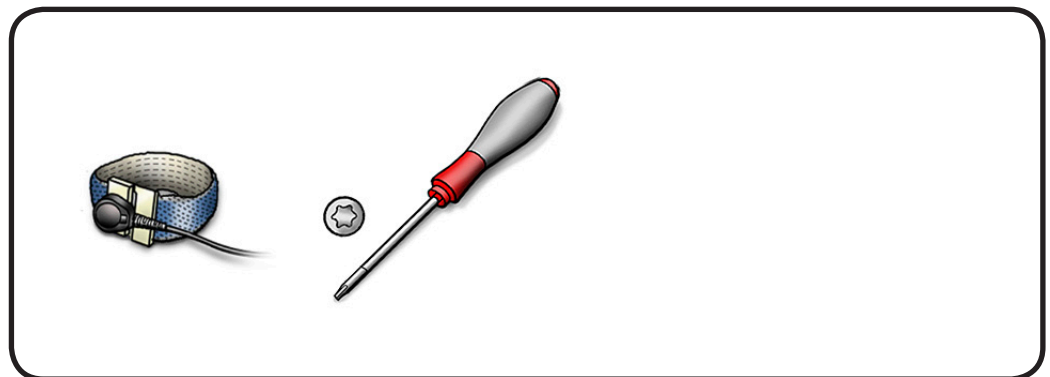
Remove:

- [Glass Panel](#)
- [LCD Panel](#)
- [Subwoofer](#)
- [Stand](#)



Tools

- ESD wrist strap
- Torx T10 screwdriver



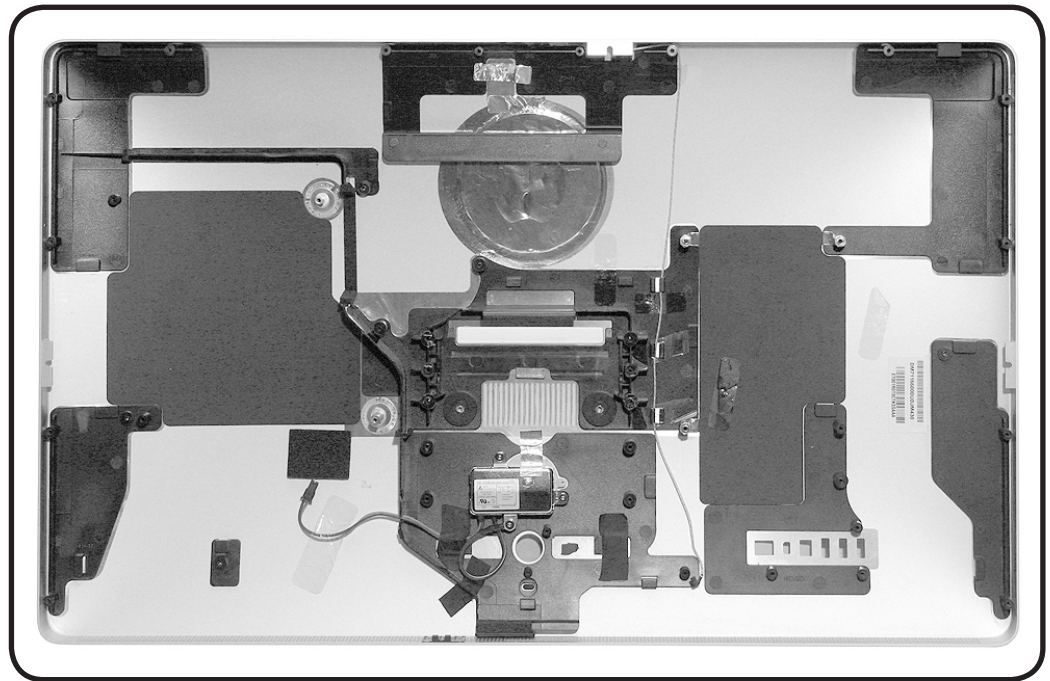


Microphone Cable

First Steps

Microphone cable is part of rear housing and is not available as a separate part.

If microphone cable needs to be replaced, follow rear housing procedure.



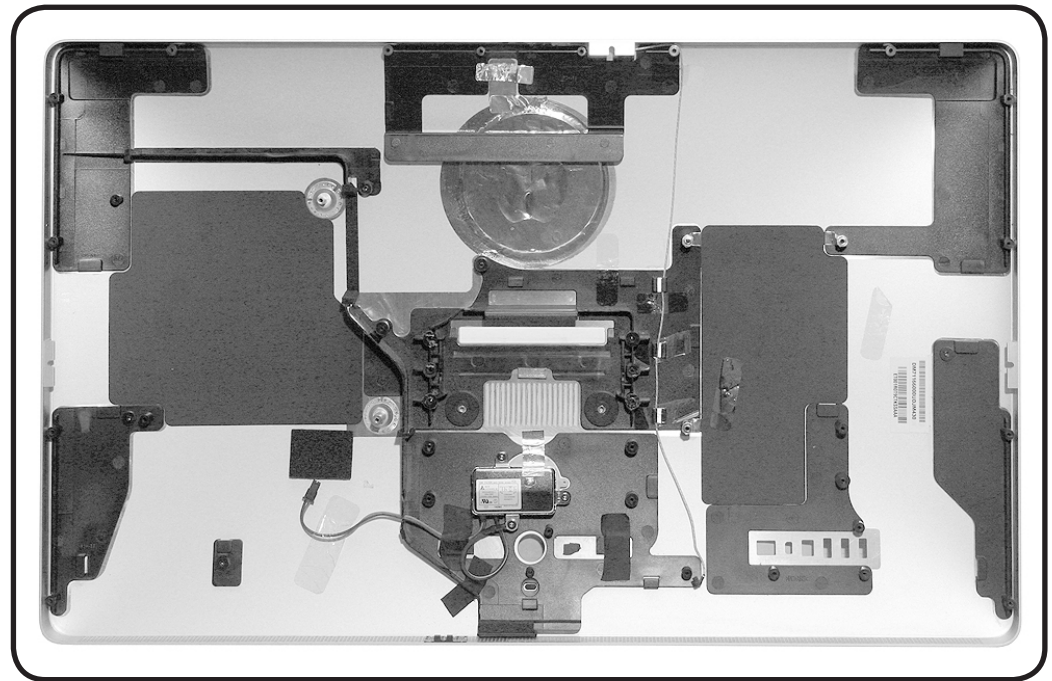


Rear Housing

First Steps

Remove:

- [Glass Panel](#)
- [LCD Panel](#)
- [Camera](#)
- [Camera Cable](#)
- [Power Supply](#)
- [Fan](#)
- [Logic Board](#)
- [DC Power Cable](#)
- [Left Speaker](#)
- [Right Speaker](#)
- [Subwoofer](#)
- [All-In-One Cable](#)
- [Stand](#)
- [Mechanism](#)



With all other modules removed, rear housing is the remaining assembly.

A new rear housing includes the following parts, which are NOT available separately:

- microphone cable
- AC inlet

A new rear housing also includes:

- new "H" tape for DC power cable
- new "H" tape for pressure wall to left of subwoofer
- 3 new black EMI tapes for all-in-one cable and left speaker cable
- new aluminum foil tape for camera cable

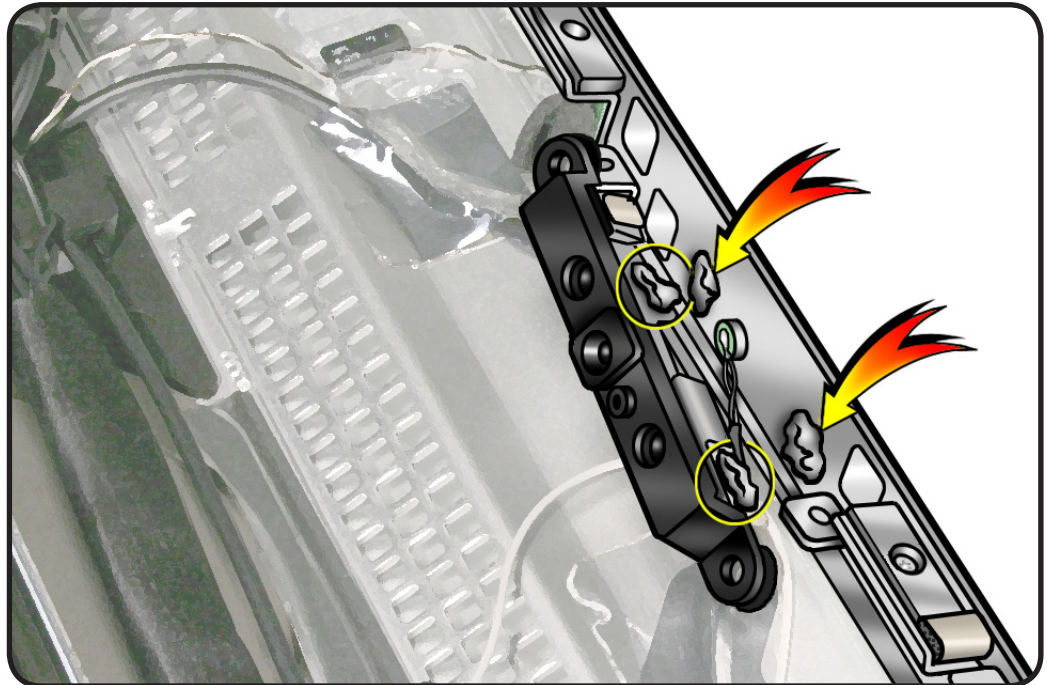


Camera Thermal Material

- 1 Thermal material is required between camera and rear housing. Reuse the thermal material.
- 2 Use a black stick to remove and reapply thermal material to camera (areas circled).

Note: A syringe of thermal material is available as needed, Apple part# 922-9625, good for 5 applications.

Important: The white thermal material used on camera should NOT be used for any other purpose (such as portable computer heat sinks.)



Additional Procedures

Thunderbolt Display (27-inch)



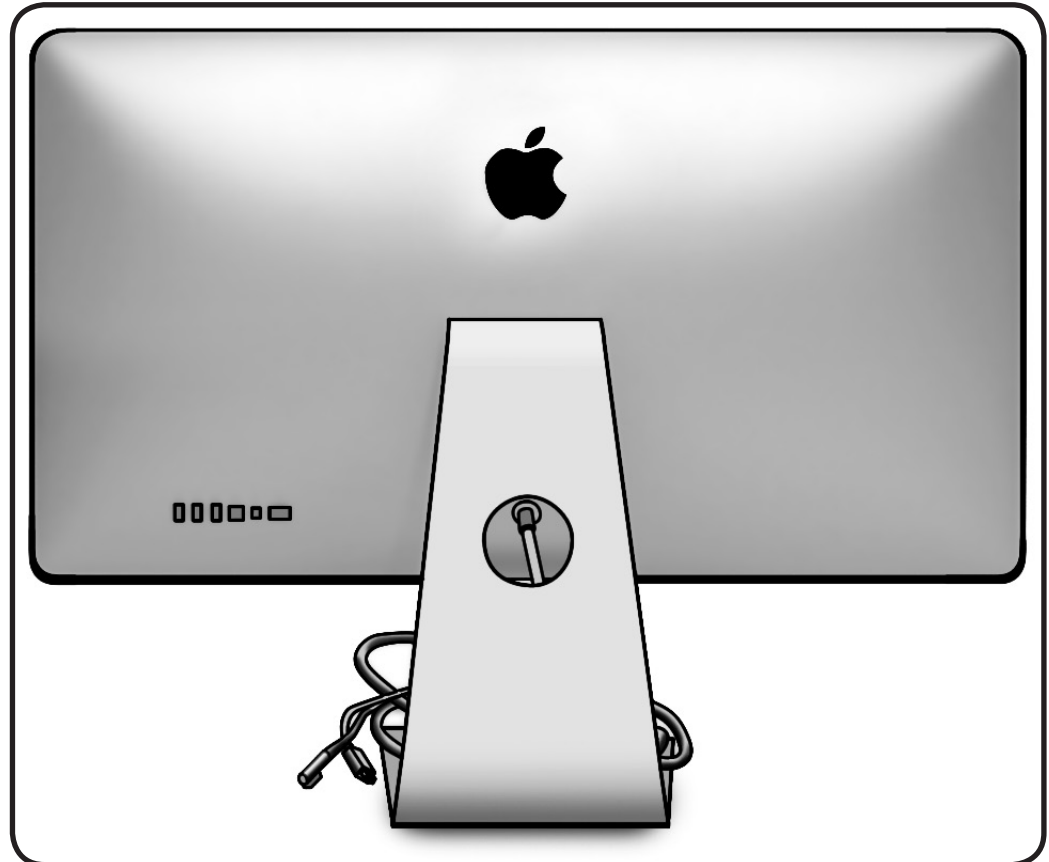
Retrieving Mechanism

Overview

Without a stand or VESA mount installed, the mechanism can retract inside the display if an access card trips the latch that locks the mechanism.

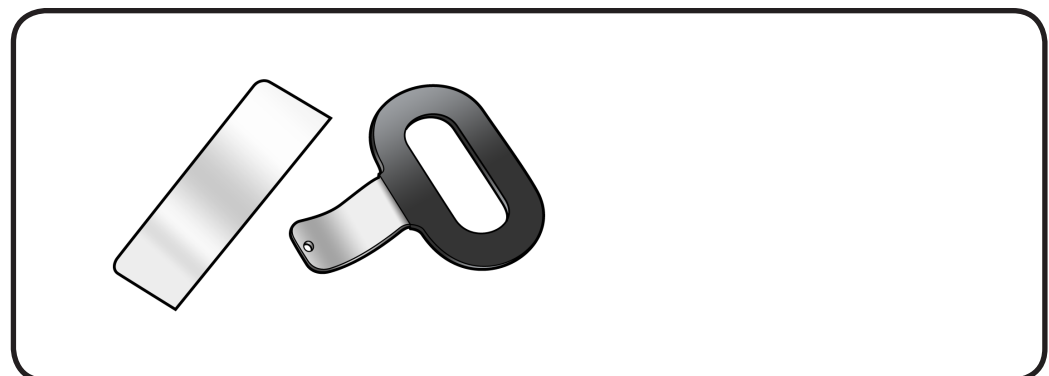
In the rare event that retrieving the mechanism is necessary, follow this procedure.

Note: You may notice small differences in appearance between the images in this procedure and the computer you are servicing. Although the appearance may differ, the steps and sequence are the same unless noted.



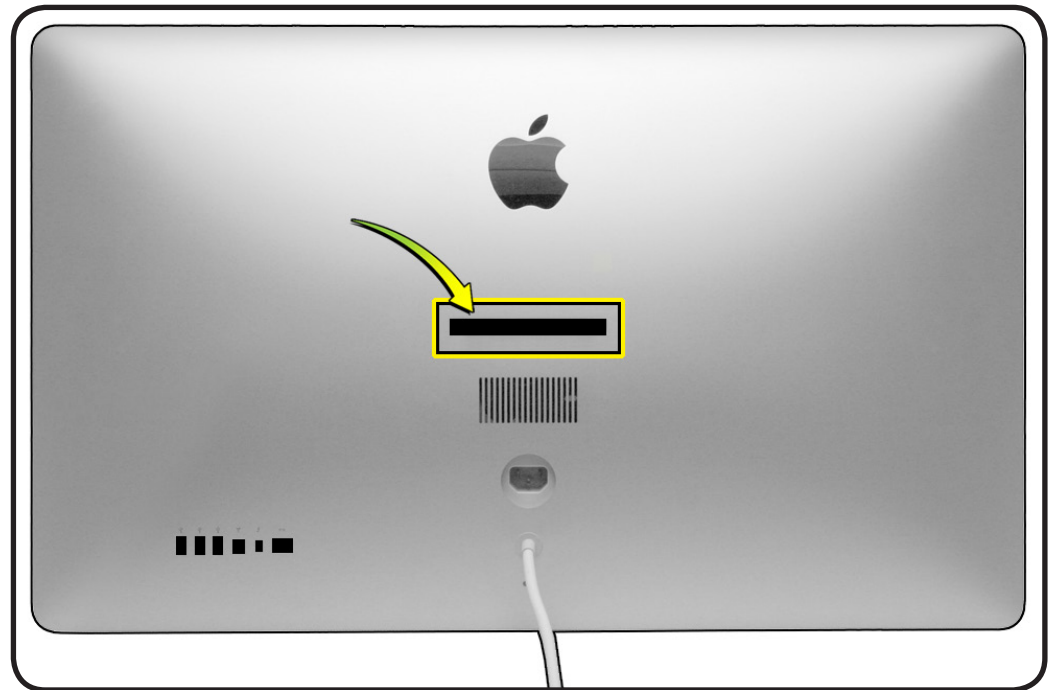
Tools

- Access card (Apple part #922-7172)
- Retrieval tool (Apple part #922-7849)
- Scissors to cut access card in half

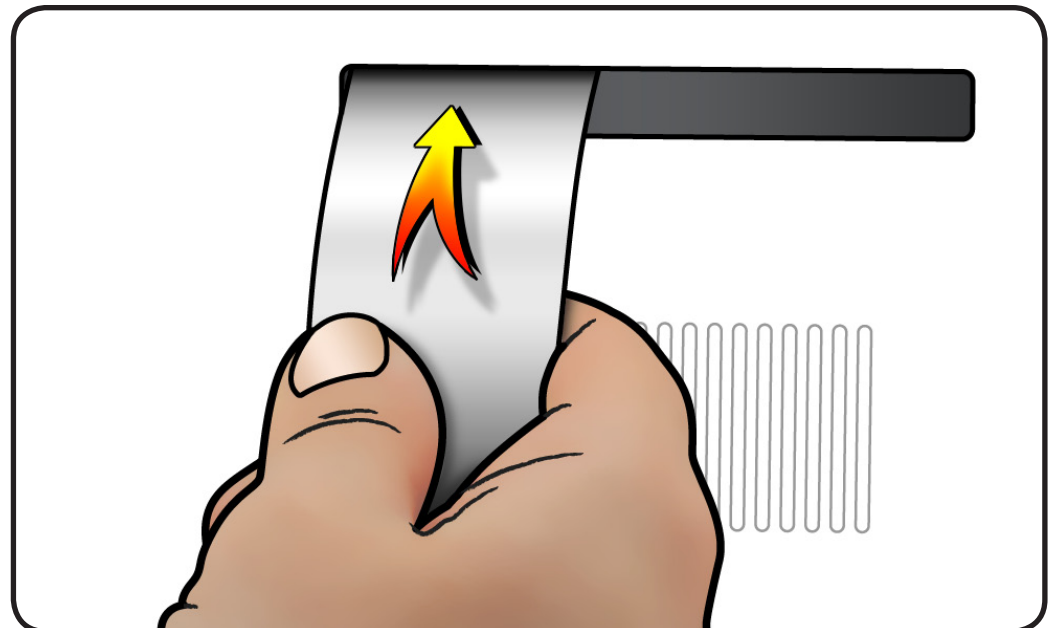


Removal

- 1 Place display face down on a clean, soft surface.
- 2 Peer into stand slot to see recessed latch. Latch is a shiny metal spring clip located above mechanism that is almost as wide as stand slot.



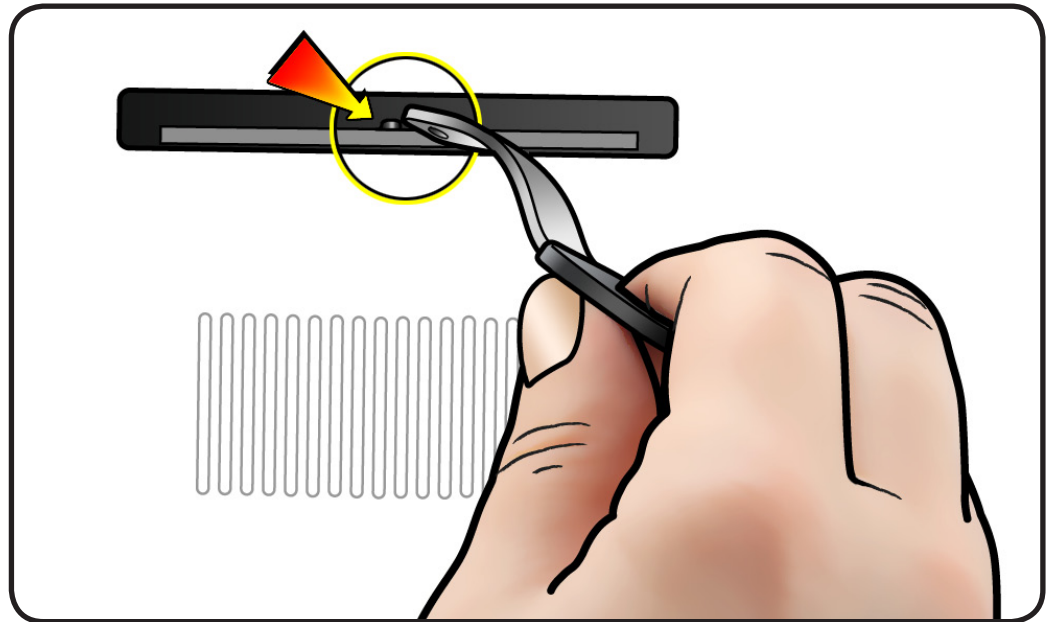
- 3 Cut access card in half vertically, into two equal halves.
- 4 Insert half of access card into one end of stand slot and push latch away to get a sense of how latch moves.





5 Notice shape of retrieval tool. When inserting retrieval tool, make sure curved end of tool is down, as shown.

6 The small hole on end of retrieval tool will hook onto pin on recessed mechanism.

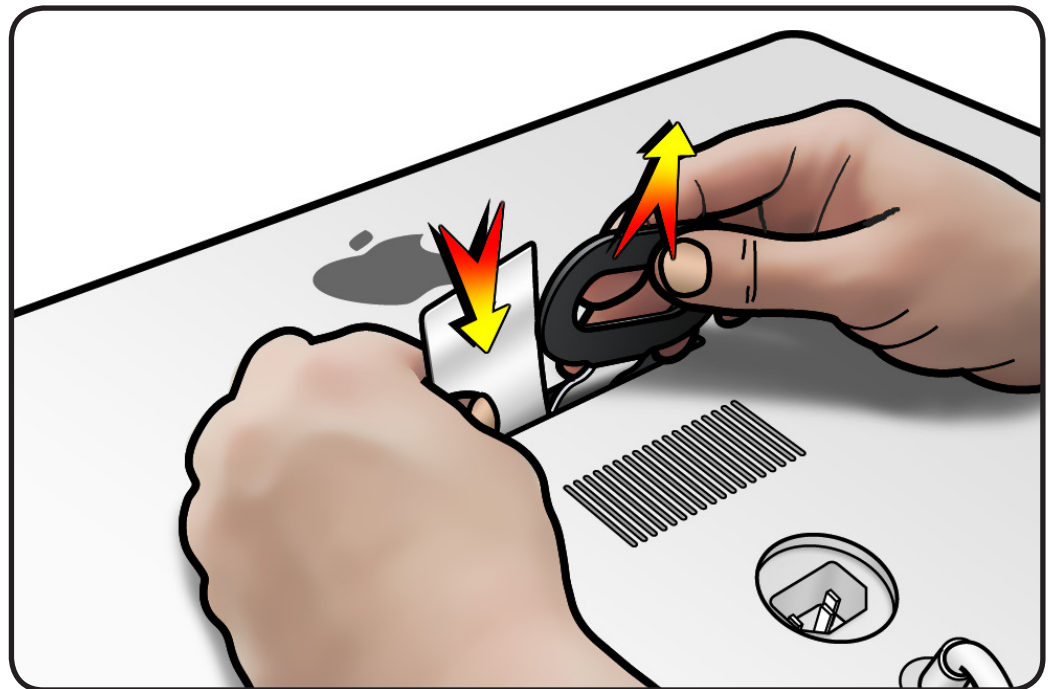


7 Hold access card so latch is pushed as far as possible.

8 Align retrieval tool over pin on mechanism.

9 Have an assistant hold unit down firmly as you simultaneously push latch away and pull mechanism towards you.

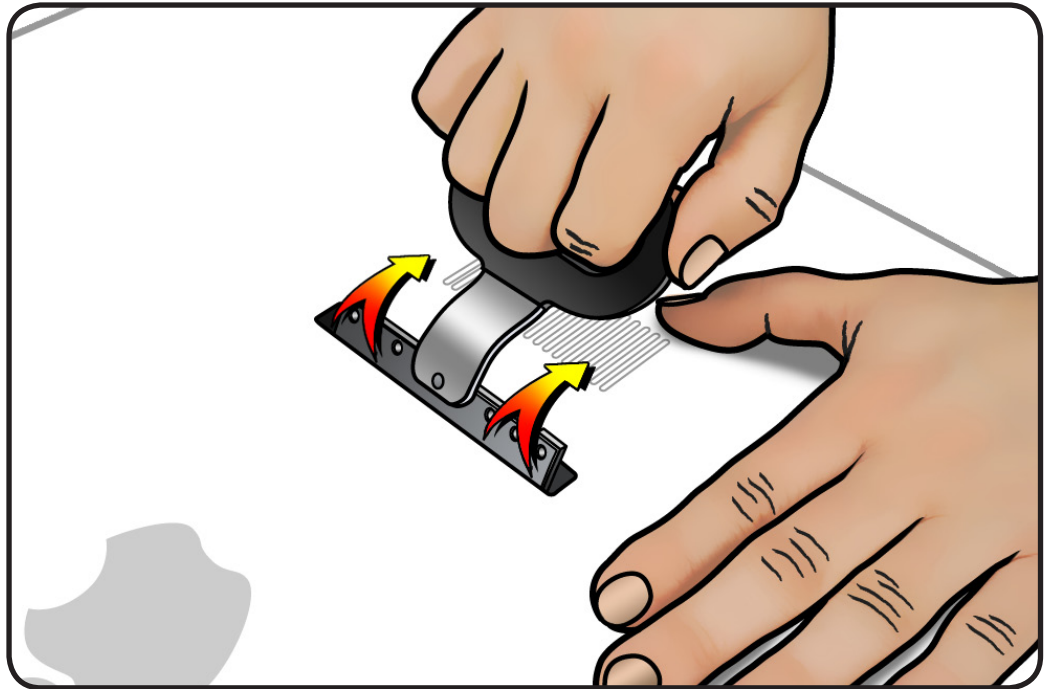
Note: There is a lot of tension on mechanism and it will take a lot of force to pull it up.



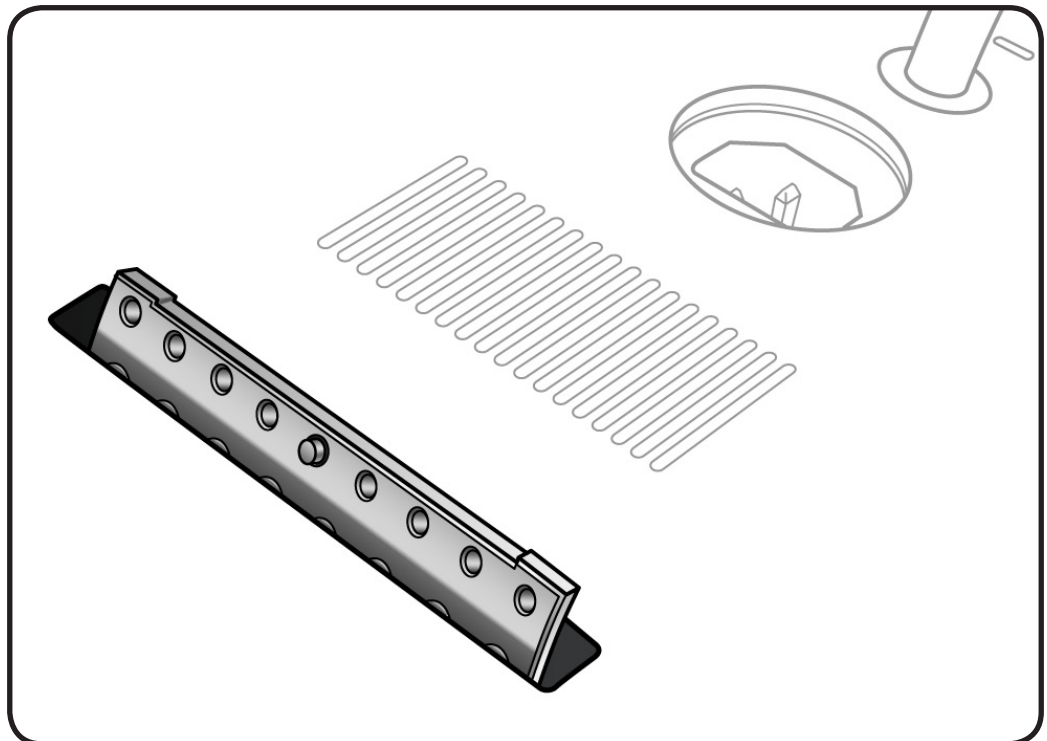


10 When you can pull up mechanism and see it emerge through slot, maintain pull force on retrieval tool, but remove access card.

11 Pull up mechanism until it clicks or locks into place.



12 Mechanism is now ready to accept installation of stand or VESA mount.

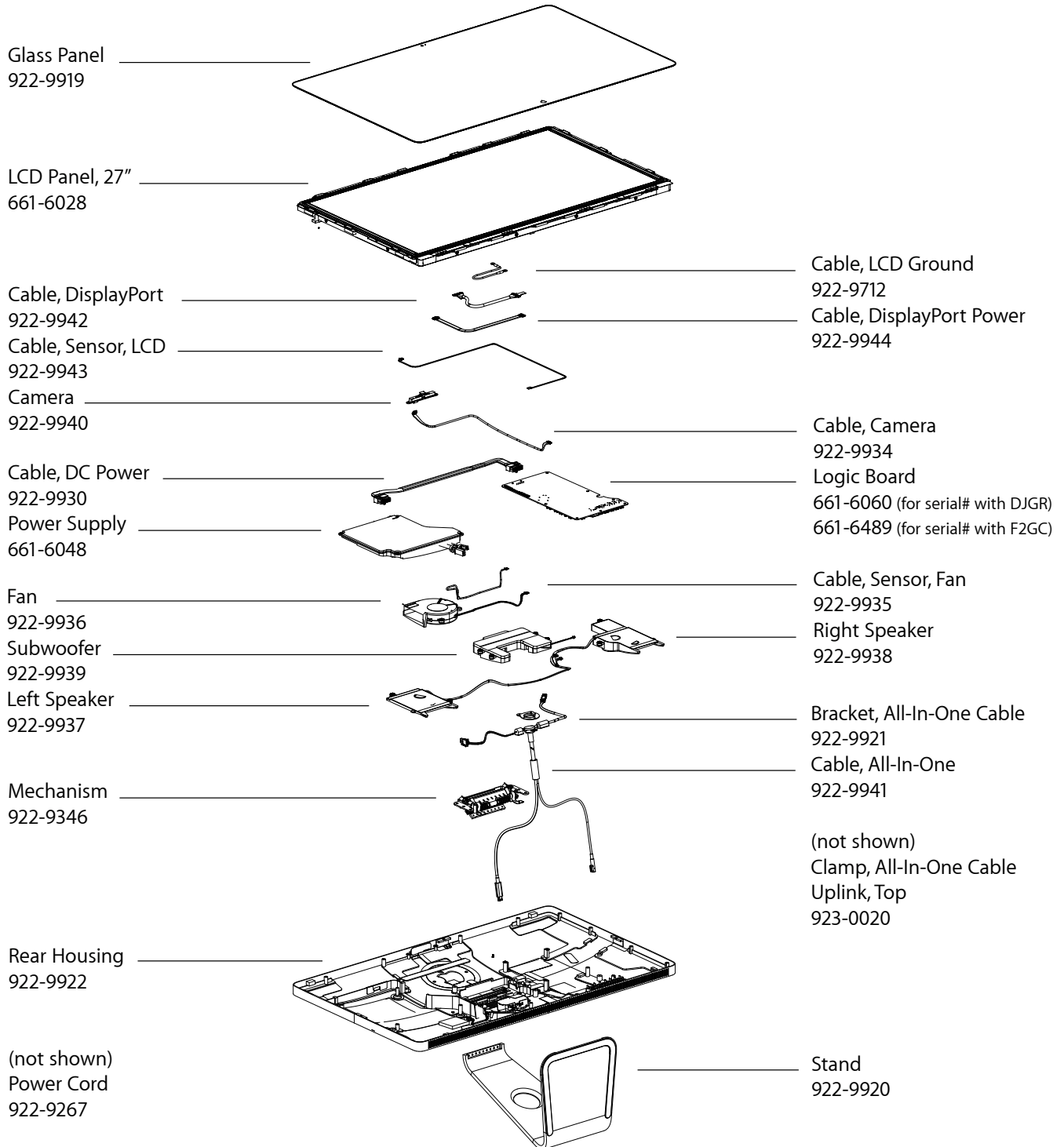


Views

Thunderbolt Display (27-inch)



Exploded View





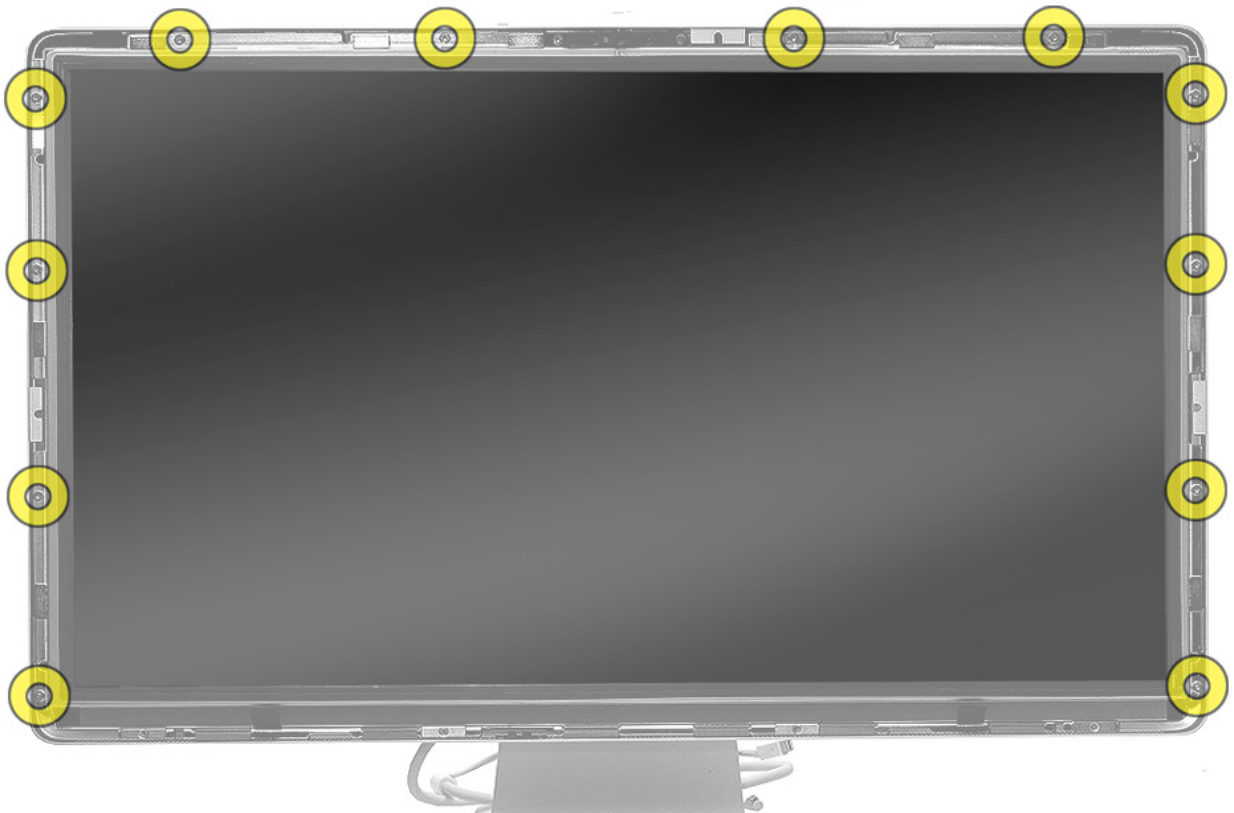
Screw Chart



922-8685 T10, machine  Power Supply (2); All-in-One Cable Bracket (1)	922-8749 T10, machine  Stand (8)	922-9349 T10  Mechanism (6)
922-9351 T10  All-in-One Cable Bracket (2)	922-9353 T10, with foam gasket  Mechanism (2)	922-9722 T10, shoulder  Subwoofer (4)
922-9723 T10, shoulder  Camera (2)	922-9724 Phillips #0  LCD Ground Cable (1)	923-0006 T10  LCD (12); Power Supply (2); Logic Board (8); AC Inlet (2)
923-0007 T10, shoulder  Fan (3); Left Speaker (2); Right Speaker (2)	923-0008 T6  Clamp, All-in-One Cable Uplink, Top (2)	



Screw Location Diagrams

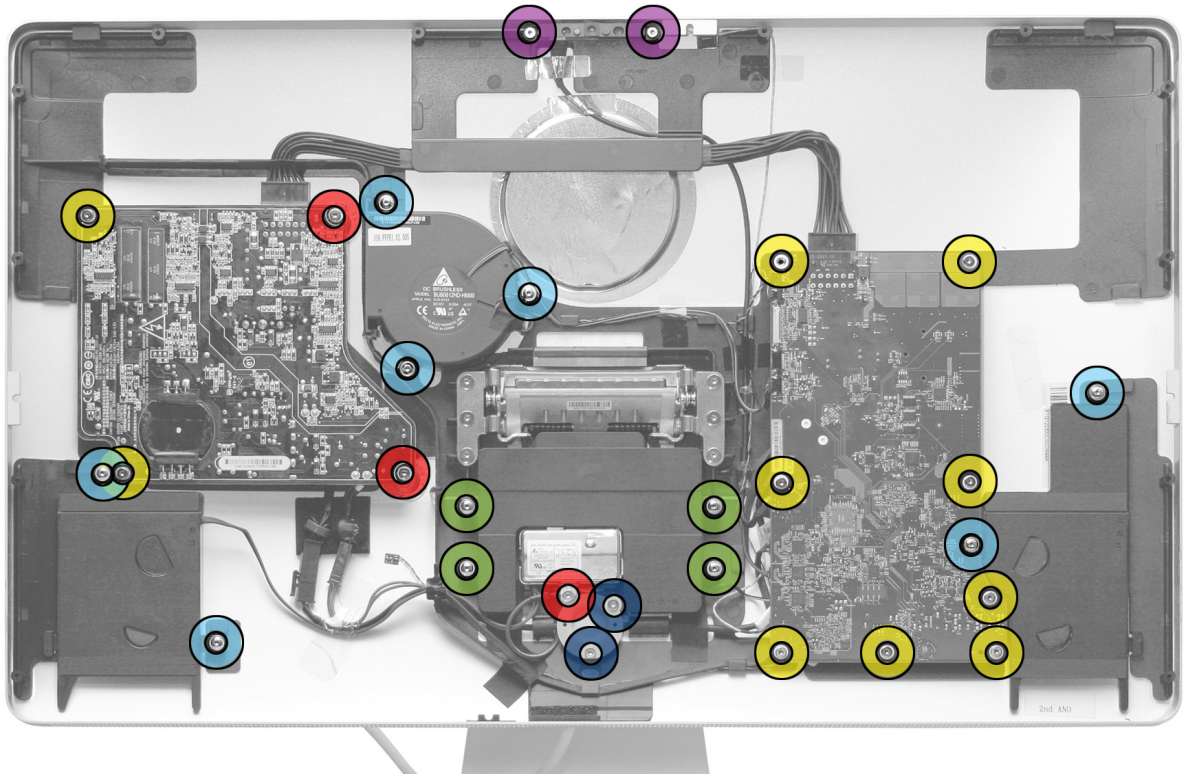
LCD Panel









Key	Photo	Part#	Type	Where Used
		923-0006	T10	LCD panel (12)



Below LCD Panel



Key	Photo	Part#	Type	Where Used
		923-0006	T10	power supply (2) logic board (8)
		922-8685	T10, machine	power supply (2) AIO cable bracket (1)
		922-9351	T10	AIO cable bracket (2)
		923-0007	T10, shoulder	fan (3) left speaker (2) right speaker (2)
		922-9722	T10, shoulder	subwoofer (4)
		922-9723	T10, shoulder	camera (2)



External Views

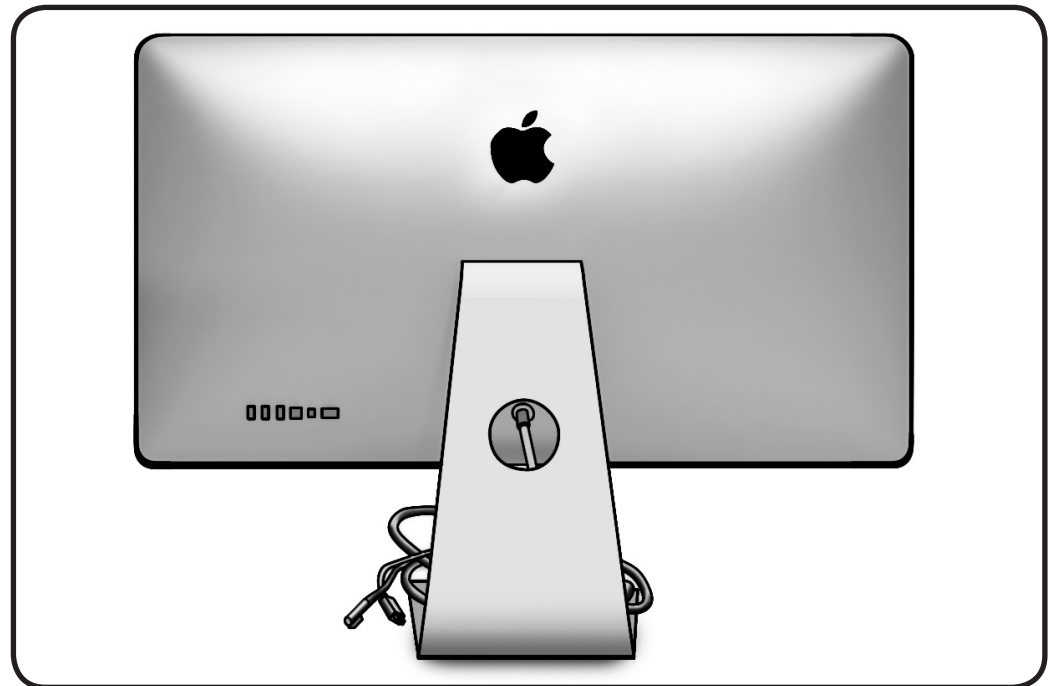
Front View





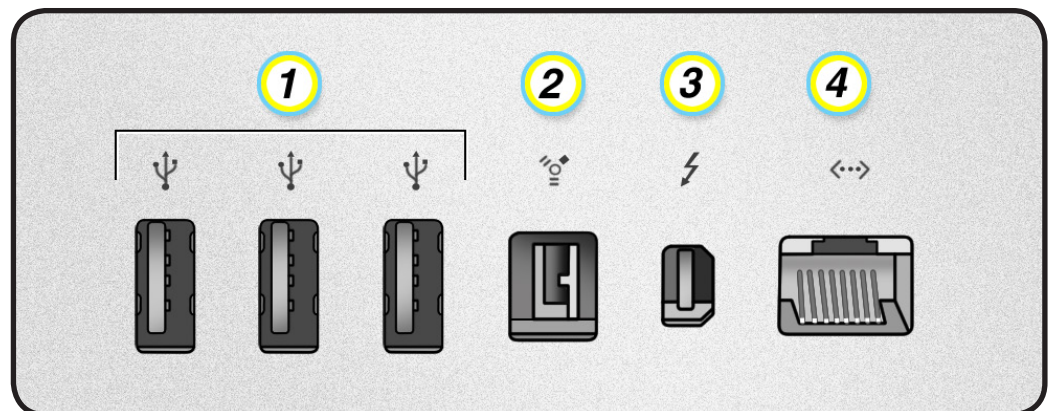
Rear View

The stand is removable in order to allow the use of a VESA mount.



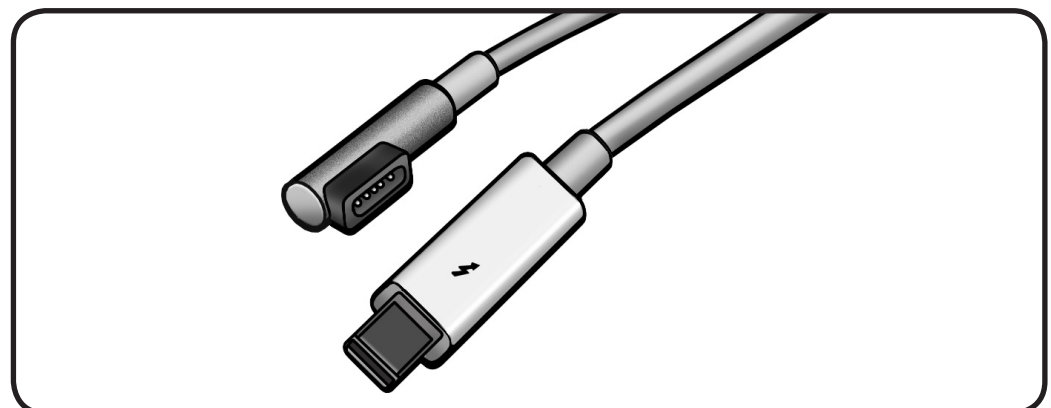
I/O Ports

1. USB 2.0
2. FireWire 800
3. Thunderbolt
4. Gigabit Ethernet



All-In-One Cable

MagSafe power and Thunderbolt.





Internal Views

Components below LCD

